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Prospective Memory Rehabilitation:
Electronic Organizer Training through Computer Assisted Cognitive Rehabilitation

by

Jill Patricia Owen-Flood ©

A thesis submitted to the
Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of
Master of Education.

in

Instructional Technology

Department of Educational Psychology and Technology

Edmonton, Alberta

Fall 1994

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August 31, 1994

Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled **Prospective Memory Rehabilitation: Electronic Organizer Training through Computer Assisted Cognitive Rehabilitation** submitted by **Jill Patricia Owen-Flood** in partial fulfillment of the requirements for the degree of **Master of Education** in **Instructional Technology**.

Michael Szabo

Dr. M. Szabo

Dr. D.J. Collett

Allan R Dobbs

Dr. A.R. Dobbs

Professor M. Miyazaki

July 19, 1994

DEDICATION

To my daughter Melinda who brought joy and laughter.

She died of a brain injury at eight years of age and is sadly missed.

It is in her memory that this research was undertaken.

ABSTRACT

A Computer Assisted Cognitive Rehabilitation (CACR) program was designed to assist neurologically impaired people with memory deficits to use an Electronic Organizer (EO) as a prospective memory assistive device.

Memory deficits are a frequent outcome of injury to the brain which prevent the person from being able to function independently in the community (Sohlberg and Mateer 1989a). Prospective memory encompasses several functions which are not memory related: metaknowledge, planning, monitoring, content recall, compliance and output monitoring (Dobbs and Reeves, 1991). The EO is designed to compensate for deficits in one or more of these functions. The consequences of brain injury are pervasive and the person's ability to learn new information is compromised (Lezak, 1983). Therefore, the EO CACR program incorporated training strategies which are known to be effective for people with cerebral lesions.

Training on how to use the EO was solely based on the CACR program which included the empirically based teaching procedures of spaced retrieval (Schacter, Rich, and Stampp; 1985), and vanishing cues (Glisky and Schacter, 1987). Emphasis was put on procedural learning whereby step-by-step computerized guidance was given in the CACR program to teach the learner how to use the CALENDAR and SCHEDULE sections of the EO. Spaced retrieval was used to teach people the order in which to click the keys to open the sections, and vanishing cues was the technique used to gradually fade out the step-by-step instructions on how to access the CALENDAR and SCHEDULE sections. The total program was successful, but it was not possible to specify which of the two individual components was most effective.

The purpose of this research was to determine the efficacy of the EO CACR program to teach people to use an EO to plan for future events. Therefore, it was necessary to demonstrate generalization of learning from the CACR program to functional use for the person's everyday memory needs. A Preinstructional - Postinstructional Assessment procedure was used and subjects who were initially unable to use the EO on the Preinstructional Assessment achieved 100% on the Postinstructional Assessment.

The results showed that a person with Closed Head Injury (S1) and a person with an aneurysm of the posterior cerebral artery (S2) were both able to learn to use an EO through the CACR program and generalize that learning without being cued by the CACR.

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Life's journey has taken me down many roads and there are those people in my life who will remain dear to my heart forever. They are too many to name but they have touched my life in special ways and, though they are unaware of it, they have given me the help I needed to persevere and achieve my long standing goal of conducting brain injury research.

Without the richness of an academic community, undertaking this study would have been extremely difficult. Therefore, I want to thank Dr. Michael Szabo, my supervisor, for his continuous support and professional dedication. His sense of humor was invaluable because he made laugh when I needed a laugh to keep me going. It has been a pleasure to work with him and I shall always be grateful to him for encouraging me to enter the field of Instructional Technology. I am also deeply grateful to Professor Masako Miyazaki for her continuous support and enthusiasm. I am indebted to Dr. Allen Dobbs for generously contributing his knowledge and expertise. Finally, I extend my appreciation to Dr. David Collett for his thoughtful and conscientious guidance. It was most gratifying to have such marvelous cooperation from four people with diverse backgrounds who have worked so well as a team. To them I offer my sincerest thanks.

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In closing, I want to say that what is important about a journey is not just the destination but the people one meets along the way and I have been most fortunate. In this regard, my journey has, indeed, been rich.

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I. OVERVIEW OF THE PROBLEM

In 1986, Glisky, Schacter and Tulving wrote that:

> A major task for future research will be to determine how patients can use their acquired knowledge of the computer to facilitate independence in day-to-day activities (p. 309).

Memory deficits are recognized as being the most frequently occurring consequence of injury to the brain (Freeman, Mittenberg, Dicowden and Bat-Ami, 1992). The compensatory approach is increasingly being recognized as the most successful means of dealing with the pervasive problem of memory deficits. Therefore, on a personal visit to Dr. C.A. Mateer in June 1992, she suggested that the researcher design a Computer Assisted Cognitive Rehabilitation (CACR) program to assist people with injury to the brain to learn how to use an Electronic Organizer (EO) for their prospective memory deficits.

Essentially there are two types of memory. One is retrospective memory which is remembering what has happened in the past and the other is prospective memory which is remembering to do things in the future. Prospective memory is necessary for routine activities such as remembering: where one put the car keys; paying bills or turning off the stove. That is why prospective memory rehabilitation is of interest to researchers and practitioners. Mateer, Sohlberg and Crinean (1987) found that not only does prospective memory cause difficulty for the general population but it is a major determining factor as to whether or not the patient will be able to live in the community as an independent person. In accordance with Berrol (1990), "Cognitive rehabilitation is broader than cognitive retraining since the goal of rehabilitation is functional adaptation in daily life activities" (p. 219). The EO CACR program is consistent with cognitive rehabilitation because it involves instruction in the use of an EO to enable people with acquired injury to the brain to compensate for their everyday memory needs.

The Primary Research Question

1. **Did the functional outcomes of the Preinstructional and Postinstructional Assessments (PPA) demonstrate that the subjects learned how to use the Calendar and Schedule sections of the EO through the CACR program (See the Appendix B).**

The Secondary Research Questions

2.1 **Did the efficiency scores of the subjects for the first time completion of Unit 3, Spaced Retrieval, Trials 1, 2, and 3 indicate that the subjects benefited from the technique of spaced retrieval (Schacter, Rich and Stampp, 1985) whereby the subjects improved their skill in locating and clicking the correct "keys" on the computer for finding a specific date in the SCHEDULE section of the EO?**

2.2 Did the efficiency scores of the first run of Unit 6, Exercises 2, 3, 4, 5, and 6 show that the subjects benefited from the technique of vanishing cues (Glisky and Schacter, 1987) whereby they learned how to: (1) open the SCHEDULE section for the designated date; (2) to set the time and alarm; and (3) correctly enter the prescribed tasks into the EO?

Significance of the Study

More people than ever before are surviving the acute stage of brain injury so there is an increasing need for efficacious, post-acute rehabilitation programs that are cost effective (Arnow, 1987). This involves a rehabilitation approach where CACR is used to train people with neurological impairments to use an EO as a compensatory device for prospective memory. While considerable time and effort goes into the design of CACR programs, once they are designed, CACR is cost effective. That is why this outcome study was undertaken and why this study was necessary.

Evidence of generalization of the learnings obtained in the laboratory setting are the most important outcome of memory rehabilitation programs. Therefore, it is not merely evidence from the computerized data collection that is required but also evidence of the Ss having made functional use of the EO for everyday needs. Efficacy studies are needed to assess the outcomes of cognitive rehabilitation programs (Hanlon, Dobkin, Hadler, Ramirez and Cheska, 1992) and that was the purpose of this research.

The EO CACR program was designed to teach people to use an EO for their everyday memory needs and as Dobbs and Reeves (1991) point out, prospective memory is necessary for routine activities such as remembering special occasions, performing tasks and remembering to take medications at the correct time.

Delimitations of the Study

Only two subjects were included in the study because the EO CACR program required intensive training for an extended period of time. The study was limited to people with documented evidence of acquired injury to the brain that was of adult onset. The subjects were required to be at least 18 months post-injury because it was necessary to exclude people who were still in the recovery phase because it has been shown that spontaneous recovery takes place up to at least one and a half years after the trauma (Lezak, 1987).

The EO CACR program was designed to facilitate functional use of an EO for everyday memory needs and the CACR program was not intended as an academic exercise in cognitive rehabilitation. With regard to long-term follow-up, Subject 1's (S1's) use of the EO was done through reviewing what he had entered in his EO. However, this assessment could not be done for Subject 2 (S2) because he did not have an EO to use outside the laboratory setting.

Limitations of the Study

The results of this study may not be generalizable because it involved only two subjects who had sustained different lesions. One had a Closed Head Injury (CHI) and the other had a right posterior cerebral artery aneurysm which was clipped. Therefore, because of the different types of neurological insult to the brain and because of their premorbid differences, generalizations of research findings cannot be drawn from this study.

A limitation of the study was that while the EO CACR program was successful as a whole, the relative merits of spaced retrieval versus vanishing cues could not be determined.

In addition, S1 was able to work with the EO CACR program for 12 sessions. But, S2 lived out of town and attended only 5 sessions. This enabled S1 to gain increased efficiency in learning how to use the EO however S2 did not have the same advantage.

Glossary of Terms

Closed Head Injury: CHI is injury to the brain that takes place without an open injury to the skull. Usually, this is the result of acceleration - deceleration and then a sudden stop. This usually results in diffuse brain injury (Lezak, 1983).

Coma: This is the post-injury stage where the person is unable to engage in any organized or purposeful interaction with the external environment. In the higher stages of coma, the person responds to environmental stimulation by a generalized, whole-body movement or a non-directed motor response. Whereas, in deep coma, the person may not respond to touch, pain, sound or movement . There is some predictive correlation between length of coma and eventual outcomes, however, a coma of prolonged duration may be followed by a relatively good recovery and the opposite may also be true (Sohlberg and Mateer 1989b)

Cues: Partial bits of information (Sohlberg and Mateer, 1989b)

Computer Assisted Cogitative Rehabilitation (CACR): This is cognitive rehabilitation for people who have sustained injury to the brain whereby a computer is used to assist in the cognitive rehabilitation process but the computer is not intended to substitute for the close supervision and interpersonal communication between the clinician and the learner.

Computer Assisted Instruction (CAI): This is instruction that is presented via a computer whereby the information to be learned is presented in a structured manner, the learner's responses are evaluated and feedback is provided.

Electronic Organizer: An EO is a hand held mini-computer which serves the purpose of an electronic day timer. It has an alarm that can be set to ring at various times for tasks that have to be done and these tasks are preprogrammed into the SCHEDULE section. It also tells the time, has a CALENDAR section and telephone section et cetera.

Efficiency score: This is the score that is obtained by dividing the length of time it takes the participant to answer a series of questions by the percent correct score that the participant obtained.

Episodic memory: This involves memory for specific times and places about who was there and/or what happened. Loss of episodic memory is a frequent problem following injury to the brain. Compensatory external memory assistive devices are used to offset the loss of episodic memory (Sohlberg and Mateer, 1989b).

External file: This is a file that is accessed through the software package Excel and for each exercise in the CACR, it documents the date the exercise was performed on, the efficiency score the person obtained, the percent correct score and the length of time in the participant spent doing that particular exercise.

Hemianopia: Blindness in the side of the visual field that is on the opposite site of the lesion to the brain (Berkow and Talbott, 1977)..

Implicit memory: This is learning that takes place without conscious awareness whereby the person gains familiarity with something because of repetitive priming (Schacter and Graf, 1987).

Learning: This is the ability to acquire new information (Lezak, 1983).

Metaknowledge: This has to do with general knowledge about the task that is to be performed (Dobbs and Reeves, 1991).

Priming effects. This refers to cues or particular information which can help the person remember desired information. Priming effects work for people with and without injury to the brain and the theory is that prior exposure of the information to the nervous system changes the nervous system so that the information can be recalled when the pertinent cues are provided (Sohlberg and Mateer, 1989b).

Procedural learning: This type of learning is learning without awareness of learning having taken place. Procedural learning is rule based or automatic behavioral sequences and includes motor skills, classical conditioning, perceptual motor tasks or the ability to perform the sequences to operate things (Sohlberg and Mateer, 1989a).

Procedural memory: This is the capacity to engage in automatic behavioral sequences, such as running, conditioned responses, perceptual motor tasks and sequences of behavior. Procedural learning has been found to occur even though the person may be unable to say how the task was performed, or be aware of having learned how to do the task (Sohlberg and Mateer, 1989a).

Retention: The ability to store information in memory past the limits of working memory and past the limits of rehearsal (Lezak, 1983).

Retrieval: This is the ability to remember things through the recall process which involves an active, complex search for the information (Lezak, 1983).

Spaced Retrieval: This is a technique to facilitate retrieval of new information by having the learner make repeated attempts to recall the same information over progressively increasing lengths of time (Schacter, Rich and Stampp, 1985).

Vanishing Cues: This is a visual priming technique to teach a sequence of steps necessary for effective use of a computer data entry task whereby the steps, or cues, are gradually reduced as the learner acquires the ability to perform the designated task (Glisky, Schacter and Tulving, 1986).

Working memory: This is a theoretical construct presented whereby a 'central executive' provides temporary storage of information and allows divided attention while processing information (Baddeley, 1986).

The Structure of the Study

This chapter presented an overview of prospective memory and its importance for the routine activities of daily living. The purpose of the study and the research questions were presented along with the significance of the study, the limitations, delimitations, and glossary.

The rest of this study will address: The review of the selected literature; the methodology; the analysis of the data, the design, development and implementation of the EO CACR program; the presentation and discussion of results; the summary, recommendations and conclusion.

II. REVIEW OF THE SELECTED LITERATURE

This review of the literature will address: prospective memory, prospective memory rehabilitation, computerized cognitive rehabilitation, the advantages of CAI, the EO CACR program and organic brain injury.

Prospective Memory

This section will review prospective memory and self-reports, time-based and event-based prospective memory, and the conceptual framework for prospective memory.

Prospective Memory and Self-Reports

Dobbs and Rule (1987) examined age related differences in prospective memory and the relationship between between metamemory, or knowledge about one's memory, and use of compensatory memory aids. To assess this, they used a metamemory questionnaire and two prospective memory tests. Dobbs and Rule found that as people got older their complaints about their memory problems decreased. Indications were that this is because in order to remember having memory problems, one has to be able to remember having forgotten what should have been remembered. They also found that there was an absence of relationship between reported memory problems and the use of memory aids. The Dobbs and Rule study found that people in their 40's used external memory aids but that older people tended not to so. This result was in contrast to that of Moscovitch (1982) who found that older people did use memory aids.

With regard to a head trauma patient, Dobbs and Rule referred to an incident where a patient informed his neurologist that he (the patient) did not have any memory problems. But, he also reported that when he read a page, he was unable to absorb what he read. Dobbs and Rule referred to the importance of the discrepancy between the lay person's concept of memory deficits and the psychologist's concept of memory deficits. In addition, patients with severe memory deficits tend to be unaware of the fact that they have memory problems even though the consequences of these deficits affect their routine daily activities. Hence, the importance of awareness of deficits in order to recognize and dedicate time and energy to overcome prospective memory problems. The importance of awareness of deficit has been written about extensively (Prigatano and Schacter, 1991).

Time-based and Event-based

Einstein and MacDaniel (1990) address two types of prospective memory. One is time-based and the other is event-based. Time-based prospective memory requires the person to remember to do a certain thing at a certain time. Whereas, event-based prospective memory requires the person to remember to do a certain thing when a certain situation occurs. An example of a time-based memory task is to remember to phone home at 4:00 PM. In contrast, an example of an event-based task is to remember to give someone a message when you see the person. The primary use of the EO would be for time-based memory tasks and the primary relationship to event-based tasks is that the person has to learn to open the EO when the alarm rings at the time the task is to be performed.

Conceptual Framework

Dobbs and Reeves (1991) developed their conceptual framework for prospective memory which has the following six components. These are metaknowledge, planning, monitoring, content recall, compliance and output monitoring.

i. Metaknowledge is general knowledge about the task that is to be performed. This includes advance planning and setting up appropriate cues to indicate the content of what has to be done in accordance with the time and/or place where the event is to take place.

These researchers state that metamemory needs further investigation. Metaknowledge is necessary to have awareness of the need to use an EO and the ability to plan successfully to use the EO for everyday memory needs.

ii. Then there is planning which can be as simple as making a note in a calendar or as complex as making repetitive checks on a regular basis or after an important event has taken place.

Planning is also involved in the use of the EO because the person has to make a point of planning to use the EO everyday and entering tasks into the SCHEDULE section. Then the person has to set the alarm to ring at the appropriate time and keep the EO with them. When this is done, it eliminates the need to make regular checks for time-based tasks because the alarm rings to remind the person.

iii. Next is monitoring which can present difficulties for people even when they have every intention of performing the task. The type of monitoring for prospective memory tasks varies with the type of tasks which could be either time-based or event based.

The EO is suitable for time-based tasks but not for event-based tasks and people with brain injury tend to have difficulty with dual processing. Often, they are able to do one task at a time, but are unable to concentrate on two tasks simultaneously so the EO would be particularly useful for people who have problems working on one task while keeping another in mind. For example, the alarm can be set to ring so the person does not need to monitor for the time.

iv. The fourth component is content recall which requires that the person remember what it is that has to be done when the time comes to perform the task.

This is the retrospective component of prospective memory and knowing what had to be done when the time comes to do it can be programmed into the EO ahead of time, such as "Feed the cat". Therefore, with this memory assistive device, remembering the content of time-based tasks is not a problem.

v. The person must actually perform the task and this involves compliance. There can be many reasons why the person does not perform a task and these include failure to monitor the time, intending to perform the task at the right time and then getting distracted, procrastination or simply deciding to not perform the task.

While dealing with the problem of the person objecting to performing the task is beyond the limitations of the EO, more skilled users could use the edit command of the EO and type in whether or not the task has been performed.

vi. Finally, there is output monitoring which is important because the person must know whether or not they have performed the designated task. Dobbs and Reeves state that little research has been done in this area.

The factors listed above by Dobbs and Reeves are important for the rehabilitative process.

Prospective Memory Rehabilitation

There are two fundamental approaches to memory rehabilitation. One is restitution which is based on the belief that the mind is a "mental muscle" and can be restored with exercise and the other is compensation by using an assistive technique to circumvent permanent loss of cognitive capacity.

Restitution

Restitution is based on the theory of anatomical reorganization whereby it is believed that repetitive external stimulation will result in internal reorganization of the brain (Harrell, Parenté, Bellingrath and Lisicia, 1992). This is a controversial approach which involves the drill and practice approach to memory.

The drill and practice approach has been widely used in computer programs for people with brain injury. However, the restitution approach has fallen into disfavor because it is inadequate for overcoming memory deficits (Wilson, 1982). Another problem with repetitive drills is that people with injury to the brain usually fail to generalize this type of learning for everyday memory needs So, while computerized data collections show "objective" evidence of improved memory, the fact is that, more often than not, no real life improvement in memory has taken place.

Compensation

The second approach to memory rehabilitation is compensation which can be either internal or external.

Internal Compensation

Internal compensation involves repetitive recall drills, and mnemonic strategy training. Repetitive practice has been used in many computer programs and this has given computerized rehabilitation a bad reputation. That is because drill and practice does not generalize and several researchers have found this approach to be the least effective approach to memory rehabilitation. The three categories of mnemonic strategies are imagery-based, verbal techniques and operant/self-instructional techniques and, again, studies have shown that these techniques do not generalize to the natural environment. Glisky and Schacter (1986) point out that these strategies do not relate to everyday memory needs and that they place undue requirements on the already overburdened cognitive abilities of people whose brain injuries leave them unable to cope with such demands.

External Compensation

Then there is training in the use of compensatory devices which have the advantage of helping the person to organize, recall and use information for routine activities. Sohlberg and Mateer (1989a) write that very little has been written about training methods or efficacy trials for assistive devices. These researchers referred to the merits of their three stage memory book training program whereby they gave intensive training over a six-month period and successfully rehabilitated their client's prospective memory deficits to the point where he was able to live independently in the community.

The EO is an external compensatory memory device and other examples include using a digital alarm watch Kurlychek (1983). Naugle, Prevey, Naugle and Delaney (1988) found that a digital watch with a data bank was successful as both a cueing device and for providing scheduling information. Schedules, checklists and notebooks are also effective in reducing the impact that memory and attentional deficits have on everyday life.

Today's technological advances make the use of electronic devices a more realistic and more dignified means of compensating for memory deficits. But to successfully utilize a compensatory approach such as the EO, the person needs to have relatively intact executive abilities. Lezak (1993) provides a four-part classification schema for executive function which include: volition, planning, purposive action and performance effectiveness. Volition involves the ability to be aware of one's self, one's surroundings and one's motivational status. Planning involves the ability to look ahead, to be objective, to consider alternatives, to make choices, to develop a plan of action and to maintain sustained attention. Purposive action involves being productive and maintaining self-regulation. Performance effectiveness involves the capacity to maintain quality control.

Successful use of Compensatory Devices

As Prigatano, Amin, and Kimberly (1993) point out, whether or not a person is willing to use a compensatory approach depends on how effective the person finds that device for meeting everyday needs. Other factors determining effective use of compensatory devices relate to the person's cognitive processes such as speed of information processing, the ability to acquire new learning strategies, the ability to initiate plans, and the ability to encode, store and retrieve information (Millis and Dijker,1993)

Sohlberg and Mateer (1989a) made a significant contribution to prospective memory rehabilitation with their training program that insured generalization of the use of a memory book to the natural environment. Their successful program was based on the three stage, special education training procedures of Haring, Liberty and White (1980); White and Haring (1980); and White and Haring (1976). The three stages are Acquisition, Application and Adaptation. At the Acquisition stage, the person is taught about the memory book. In the Application stage, the person applies what has been taught in a role play situation that mimics real life situations. Then, in the Adaptation stage, the person is taken out of the classroom into their everyday environment and the instructor gradually withdraws the cues to use the memory book as the person gains increasing independence.

The EO CACR program fits into the Acquisition stage of the Sohlberg and Mateer program and is intended to be used within their instructional paradigm. In the case of the two subjects in this study, S1 used the EO for his everyday memory needs as soon as it was given to him, as demonstrated by systematic review of the entries into his EO. There was no need to engage in the Application or the Adaptation stages. Unfortunately, S2 was not given an EO, therefore, using it in the natural environment could not be assessed. However, it was the impression of the researcher that he would have done so if one had been given. Both were high functioning subjects so engaging in the three stages of the program was not necessary. But there is no doubt that it would be necessary to use the three stage approach of Sohlberg and Mateer for people who were more severely impaired. Apart from cognitive impairment there are other reasons why a person could fail to utilize memory aids which could include absence of awareness of the deficit (Prigatano and Schacter, 1991) or absence of motivation.

Another external compensatory approach is to use a microcomputer to assist with memory deficits. Kirsch, Levine, Fallon-Krueger, and Jaros (1987), refer to a microcomputer as an "orthotic" device for dealing with the debilitating cognitive consequences of diffuse and/or focal brain lesions. These cognitive limitations include deficits in attention, orientation, memory, perception and social reasoning as well as the executive functions. With regard to clinical research they point out that three types of interventions are used. The first is the drill and practice, such as visual scanning (Weinberg, Diller, and Gordon, 1977); or the use of compensatory strategies such as the mnemonic of visual imagery (Lewisohn, Danaher and Kikel, 1977). The second, is retraining of neurocognitive abilities. The third, is modifying the person's environment to facilitate independence. These researchers pointed out that using a microcomputer as a "cognitive orthosis" came within the compensatory/functional;/environmental approach to rehabilitation.

They stated that the cognitive orthosis could increase the person's independence, reduce the demands on the caregivers, increase the person's self-esteem and broaden the number of activities the person could engage in and, lastly, would be cost effective. They added that compensation is the fundamental principle for rehabilitation programs to increase independence of the neurologically impaired person. External memory devices such as clocks, calendars, buzzers and digital watches are used to train patients to keep appointments et cetera. However, Kirsch et al add, that often patients with neurocognitive deficits are unable to use these passive assistive devices because of the severity of their injuries.

Therefore, they confirm what Harris (1978) stated with regard to active cuing devices, that is, the cuing device itself must demand the person's attention. Second, a cuing device must self-activate at the time it needs to be activated and, third, the cue must be directly related to the task that is to be performed. Kirsch et al designed a computerized task guidance system to enable a neurologically impaired person to successfully perform a cookie-baking activity through the assistance of computerized guidance. They stated that this use of a computer as a compensatory device was successful for the person in their research but further studies should be conducted. They recommended the use of computers as cognitive orthosis for tasks involving sequencing of activities for job acquisition skills. Their approach was similar to that used for the EO CACR program, however, their study did not include the training techniques of vanishing cues or spaced retrieval.

With regard to the use of computers, Lynch (1992) criticized the underlying assumptions of CACR programs for being based on the drill and practice approach and for assuming that generalization of learning will take place as the result of such training. He criticizes validation studies for employing dependent variables such as the computerized scores instead of practical outcome measures. He also maintained that CACR programs should teach people to do things and should be based on established principles of learning. He stated that the method of vanishing cues is not currently being used in popular computerized rehabilitation programs. However, he made no mention about the use of spaced retrieval.

Lynch's recommendations are consistent with the EO CACR program whereby the neurologically impaired person is taught to perform a functional task (use the EO) that is generalizable to the natural environment for everyday memory needs. In addition, practical and relevant outcome measures were used in the EO CACR program whereby a functional Preinstructional and Postinstructional Assessment (Appendix A) of the treatment procedure was used along with the computerized scores and in the case of one participant, a five month postinstructional follow-up was done to determine his continued use of the EO. Dependent variables were also used and these were the efficiency scores and the percent correct scores. Not only is the use of a computer for rehabilitation a factor for consideration but the type of software is of major importance.

Computerized Cognitive Rehabilitation

Levin (1991) referred to the problems created by the polarized views whereby one group maintains that CACR "works" versus the group that maintains that CACR is not an effective intervention. He emphasized that it is how computerized cognitive rehabilitation is used that determines its success or failure. Levin points to the advantages of CACR by drawing attention to its cost effectiveness, and its efficacy if presented within a coherent model of cognitive rehabilitation. He refers to the potential of CACR to increase the autonomy of people with acquired cognitive deficits and, thereby, eventually lead to decreased psychological and financial costs on the long-range basis. Levin recommends learning hierarchies whereby training progresses from concrete operations to formal operations in accordance with Piaget (Phillips, 1969).

The Computer Is Not Just a Tool

Gianutsos (1992), points out that computers facilitate rehabilitation by having the advantage of engaging in the dynamic factors of the real-time processing of information for speed, efficiency and multiple events. She wrote that computers can be designed to meet individual needs and provide home-based cognitive rehabilitation. She refers to computers as "mental prosthesis" and "productivity tools" (p. 26). Computers have developed beyond "drill and practice" and have become a highly modifiable and flexible means of cognitive rehabilitation. While Gianutsos did not directly refer to prospective memory rehabilitation, what she said applies to programs such as the EO CACR program.

Computer Simulated Vocational Task

Kirsch, Levine, Lajiness-O'Neill, and Schnyder (1992) designed a computer-assisted interactive procedure to guide people in the performance of a simulated vocational task which involved janitorial work. They designed a study where a portable computer was placed on top of a janitor's cart and the participants in their study performed the required tasks in accordance with the steps written on the computer screen. Their approach was successful and they made the valid point that technological interventions can be cost-effective if used for functional tasks or to decrease the need for expensive services being provided in the home. For example, training people to do their own house keeping tasks. Their step-by-step approach to train people in vocational tasks is consistent with the EO CACR step-by-step program except that spaced retrieval and vanishing cues were not used. However, these techniques were not necessary in the case of Kirsh et al because their functional goal had been met.

ProsthesisWare

Another program for computerized rehabilitation is the software referred to by Chute, Conn, Dipasquale and Hoag (1988). This is called ProsthesisWare and is intended to facilitate the activities of daily living (ADL). It is a new class of software for Macintosh computers whereby the microcomputer can be programmed to be used as an assistive device in rehabilitation to facilitate ecologically relevant ADL. These computer programs include household and environmental controllers, sequencing, speech, motor aids and external memory devices. Thus, the impaired person is able to compensate for permanent functional deficits whereby neural reorganization of damaged brain tissue is circumvented so that a functional adaptation can be made.

Also, these researchers pointed out that the results of the drill and practice computerized cognitive rehabilitation programs have been only marginally successful and they lack ecological validity for ADL. However, ProsthesisWare tools have not been widely tested but they do have face validity. Chute et al state that there is little justification for assuming that the repetition, rehearsal, internal mnemonic strategies or other traditional forms of cognitive rehabilitation generalize to ecologically relevant, functional activities of everyday living. It should also be pointed out that these approaches have also failed to be successful for ameliorating everyday memory problems.

Chute et al stated that over 50,000 people in the United States sustain head injuries each year. Therefore, given that those who survive the initial trauma tend to live a full life-span, more realistic and inexpensive approaches will have to be taken with regard to cognitive rehabilitation. As they recommend, continuous use of individualized software programs, designed to meet the personal needs of people with brain injury is necessary upon discharge from the rehabilitation settings. As Levin (1991), pointed out, whether or not computerized rehabilitation is successful depends on how and under what conditions it is used. Then, apart from the use of computers for cognitive rehabilitation, computers are also used in the field of education.

Advantages of CAI

Computer Assisted Instruction (CAI) has been used in educational settings for several decades and is becoming increasingly popular in educational institutions from elementary school to college education.

From Teaching Machine to Computerized Instruction

While the computer has far more to offer and has the potential to simulate "real life" teaching in the form of multimedia, the importance of the computer's roots in the "teaching machine" should be recognized. In fact, the technique of vanishing cues is an outgrowth of Skinner's theory and while Skinner's theories may have had their shortcomings, he nevertheless made a valuable contribution and this approach has some relevance for all of us and particularly for people with cerebral lesions. The conditioning process can be used in a positive manner such as training people to use an EO for prospective memory problems. Computerized instruction has also been used effectively in educational settings as the following research shows.

Kulik, Kulik and Cohen (1980) refer to the advent of computers in the 1950's and did a meta-analysis of 42 computer-based education (CBE) programs in which they found that junior and senior high school students raised their examination scores by approximately 0.4 standard deviations when computer-assisted and computer-managed instruction was given. However, examination scores were raised by only 0.07 standard deviations when computer enriched instruction was given. They also found that computers made a small "but significant" (p. 537) contribution to effective teaching at the college level. They found that the disadvantaged students benefitted the most and that CBE improved the attitudes of the students. It is reasonable to conclude that this finding also applies to people with injury to the brain.

Bangert-Drowns, R.L., Kulik, J.A. and Kulik, (1985). Did an outcome study on forty-eight computer based instruction (CBI) programs in the elementary school and found that outcome measures were raised by .45 standard deviation units. CBI is using computers to present instructional materials and to monitor the learning process. They found that drill and practice was effective in raising student achievement scores and found the computer was best for teaching relatively simple tasks like paired association. Their meta-analysis of computer based teaching found that final exam scores were raised from the 50th percentile to the 60th percentile and that different types of computer based teaching have different effects. They also referred to the importance that having a positive attitude towards computers has for today's society. This study draws attention to the importance of the recognition that computers have as part of today's society and this applies to many areas and included brain injury rehabilitation.

Niemiec, R., Samson, G., Weinstein, T., & Walberg, H.J. (1987) found that computers were successful when teaching relatively simple tasks and that microcomputers have increased interest in CAI. While their findings were related to instruction in mathematics, microcomputers have also been found to teach relatively simple vocational tasks Kreutzer, West, Sherron, Webman and Fry (1992).

Wodelet (1993) developed a computerized Individualized Program Plan (IPP) to assist with individualized instruction to assist teachers with the heavy workload that is involved in the individualization of instruction. His software was validated in a public school in Alberta and was found to be successful. In addition, computerized IPPs could also be used successfully on special groups such as cognitive rehabilitation programs for people who have sustained injury to the brain.

Poohkay (1994) found that computer-displayed animation significantly increased positive attitudes toward learning mathematics as compared to computerized text only.

Animation is recognized for its capacity to capture attention so this benefit would probably apply to CACR programs as well.

As Szabo and Montgomerie (1992) stated, the significant contributions that computerized instruction has to offer are in the area of self-pacing, active processing of information, providing cues, giving corrective feedback and individualized reinforcement at the time it is needed. No doubt, these factors have also supported the efficacy of the computerized instruction that has been reviewed above.

The EO CACR Program and the Literature

The EO CACR program was designed to capitalize on preserved learning in spite of memory loss It has been shown that people with memory problems are able to perform perceptual and motor skills in a normal or almost normal manner (Glisky and Schacter, 1987). Sohlberg and Mateer (1989a) used procedural and declarative learning to teach their client how to use a memory book and, likewise, the EO CACR program uses procedural and declarative learning. Cohen and Squire (1980) succinctly differentiate between procedural and declarative learning by pointing out that procedural learning is "knowing how" and declarative learning is "knowing that". The types of learning that are included in the EO CACR program are recognition memory, procedural memory, domaine-specific knowledge and declarative memory.

Recognition Memory

Jahnke (1988) defines recognition memory as the mental comparison and matching of a test stimulus to a target stimulus. He gives a real-life example of selecting a car key from several others on a key ring which is a memory matching activity. Recognition memory requires sustained attention, a normal degree of arousal and the ability to differentiate between stimuli (Hannay, Levin and Grossman, 1979). Fortunately, this type of memory is relatively spared after injury to the brain (Hirst, 1989). Retrieving information through recognition memory is much easier than trying to retrieve the same information through the recall process (Lezak, 1983). An example of recognition memory, which plays a major part in the EO CACR program, is the exercise which involves recognizing the relative location of the keys of the EO.

Procedural Memory

Procedural memory has also been found to be preserved in spite of memory deficits (Squire and Cohen, 1983). This type of learning includes perceptual-motor skills and rule based learning. The EO CACR program takes advantage of procedural learning by requiring the participants to open and store information in the EO as part of the CACR program.

Learning how to use a computer is primarily procedural in nature (Schimamura and Squire, 1988). Procedural learning involves the ability to learn sequences of behavior that are automatic or rule-based (Sohlberg and Mateer, 1989a) and mainly involves perceptual motor skills and repetitive priming (Cohen, 1984). Consequently, residual procedural memory can be used to train people to use a computer and to use compensatory memory techniques such as the EO. Procedural learning can take place even if the person does not remember ever having learned the training sequence before.

Procedural learning is one of the learning techniques that has been built into the EO CACR program. For example, the exercises which required the person to click the "keys" in the correct order to open the CALENDAR section on a computerized diagram put the subject through the sequence of steps to open that section on the actual EO. A series of repetitive procedural learning tasks have been built into the CACR program whereby the technique of spaced retrieval has been used to reinforce this learning.

Domain-specific Knowledge

A problem with procedural learning is that it is domain-specific, inflexible and not readily adaptable to new situations (Squire, 1987). However, Glisky (1992b) attests to the success of domain-specific knowledge in training a person with cerebral injury through the use of computer-assisted instruction whereby it was successfully generalized to the natural environment.

Declarative Memory

Glisky (1992a) found that people with injury to the brain acquired declarative knowledge at a much slower rate than procedural learning but their patients were able to learn some types of declarative knowledge. Sohlberg and Mateer (1989a) used the question and answer technique of declarative learning to teach their client the parts of the memory book. This technique has been used in the EO whereby the participants were told which was the 1st key to be pressed,and in the next frame of the EO CACR they were asked to type into the EO the name of the 1st key that had to be pressed..

The teaching strategies that have been built into the EO CACR program include spaced retrieval and vanishing cues incorporated into simulated interactive CACR. Also, the relationship from teaching machine to computer will be discussed as will organic brain injury.

Spaced Retrieval

Schacter, Rich, and Stampp (1985) found that spaced-retrieval is effective in helping amnesic patients learn new information. In spaced retrieval, the person is given the same questions several times over but an alternate activity is presented between the questions. This way the person is required to retrieve the same information at repeatedly increasing intervals throughout the instructional period. This approach was also found to be effective by McKitrick, Camp and Black (1992) who used spaced retrieval to help people with Alzheimer's disease overcome their prospective memory deficits.

Vanishing Cues

Glisky and Schacter (1987), successfully used the technique of vanishing cues to teach an amnesic patient how to use a computer for the purposes of data-entry for real-world employment. Originally the training took place in the laboratory, which was designed to simulate a typical work environment, then when she became proficient she was successful in obtaining regular employment. These researchers refer to the importance of their success in teaching their patient complex procedures in the laboratory setting and then successfully applying the same skills in the natural environment. The method of vanishing cues was also used successfully by Sohlberg and Mateer (1989a) to train their client to use his memory book. This man was repeatedly cued about the use of the memory book, then when he gained increasing skill, the cues were gradually withdrawn, but reinstated as necessary, until the client was able to use the memory book in a spontaneous and independent manner.

The technique of vanishing cues has been designed into the EO CACR program whereby the person is given step by step instructions on how to perform certain tasks, then, as proficiency is gained, the cues are gradually withdrawn but can be reinstated as necessary. Finally, when the person is able to use the EO without instructions from the computer, the cues are withdrawn completely.

Organic Brain Injury

Because one subject had a CHI and the other had an aneurysm of the right posterior cerebral artery, these conditions will now be covered.

Closed Head Injury

CHI is the most common type of injury to the brain, usually as a result of motor vehicle accidents where there is a coup-contre coup, because of rapid acceleration and deceleration of the brain within the skull. Memory problems are a frequent consequence. It is called CHI because the skull remains intact even though the brain is injured. There is also Open Head Injury whereby the injury to the brain is accompanied by damage to the skull.

Aneurysm of the Right Posterior Cerebral Artery

Habib and Sirigu (1987) studied four patients and found that left hemianopia and visual learning problems were associated with a single lesion of the posterior cerebral artery. Orientation problems in unfamiliar locations are prevalent as found in the research of Ross (1980) who considered topographical disorientation as being a specific memory deficit which is selectively related to imprinting or retrieval of new but not old memories.

These deficits appeared to be consistent with the informal behavioral assessment of S2. Getting lost in unfamiliar environments was evident and even though he had spent enough time in the laboratory to become familiar with the entrance, on a number of occasions, S2 mistook a closet door for the exit to the corridor. He also had a tendency to get lost coming to the laboratory but he was very conscientious about using his memory book so when that happened he phoned the researcher for assistance and it was necessary for the researcher to go to the building that he had gone to in error. The irregularities of his attendance probably made finding his way to the laboratory more difficult than would have been the case if he had come on a regular basis.

Conclusion

This review of the literature has addressed memory and the conceptual framework for prospective memory which involves metaknowledge, planning, monitoring, recall, task performance and output monitoring. The rehabilitation techniques of restitution and compensation have been addressed as well as organic brain injury. The training strategies designed into the EO CACR program have been reviewed.

III. THE RESEARCH METHODOLOGY

This chapter will discuss the research design, the participants, the data that were collected, the instruments and the ethical considerations.

The Research Design

This study used a Preinstructional - Postinstructional design which was incorporated into the single subject approach to research. Single subject research is recommended for brain injury rehabilitation and, as Wilson (1987) stated, neuropsychological evidence demonstrates the validity and generalizability of results that are obtained from studies done on individual patients. She writes that research in behavioral psychology supports this and that behavioral psychology has influenced clinical psychology. Advocates attesting to the advantage of single subject research for cognitive rehabilitation include Gianutsos and Gianutsos (1987) and Sohlberg and Mateer (1989a)

The Selection of the Participants

This section will address the criteria for admission to the study, the sample, the recruitment of the volunteers, background information on the volunteers, the instruments and the ethical considerations.

Criteria for Admission to the Study

The admission criteria for this program required that the participants had prospective memory deficits and medical evidence of adult onset injury to the brain. Also, they had to be more than 18 months post-trauma and willing to learn how to use a computer to learn how to use an EO.

The Sample

Because this was single subject research, only two participants were selected from a broad population of adults with memory deficits due to acquired neurological insult. One participant had CHI and the other had an aneurysm of the right posterior cerebral artery. Both were male and it was several years since the time of their respective neurological insults and both were dependent on a memory book prior to taking part in the study.

The subjects were selected through a presentation made by the researcher to an organization for people with injury to the brain and an advertisement was run in their newsletter. One subject attended the talk and the other participant responded to the advertisement.

The subjects were not monetarily compensated for their participation in the study and they signed a consent form to take part in the study and to permit the release of their diagnostic information and consent to do neuropsychological testing (See Appendix B).

This study involved single subject research. Therefore, it is a comprehensive study of two individuals who received individualized training and the status of each individual will be presented separately.

S1

The results of the Wechsler Memory Test (WMS), which was done at the time of the EO CACR study, showed that S1 had problems on three of the subtests (See Appendix D). Yet, in spite of his deficits on the WMS, he obtained a score of 100% of the Prospective Memory Test (See Appendix C). In addition, he was impaired to the point where he was unable to work because of the extent of the damage caused by his brain injury. He has a High School Diploma and before the injury he was employed at the executive level. Upon arrival in the EO CACR program, he demonstrated a keen interest in learning new things. S1 was 44 years old at the time of the study and he sustained a CHI eight years previously. He stated that he had stopped his car at an intersection and then he was hit by another car. He was the driver and the impact from the other car threw him out of his car window. He was thrown about seventy feet and landed on a grassy area.

This subject reported that he sustained a CHI and had loss of consciousness for eight weeks. He said that at one point, he was considered brain dead for four hours. When he came out of his coma, he was able to recognize his wife but not his daughters. He met his wife at age 15 which would suggest that distant memory remained intact but more recent memory such as having school age children was not retrievable. Upon regaining consciousness, he stated that he had to be reintroduced to the other people in his life. Later, he took speech classes and he had to relearn how to read and write. At the time of the study, S1, appeared to have some weakness of the left side of his body and he used the right hand only when on the computer.

S2

In contrast to S1, the results of the Wechsler Memory Test which was done after the EO CACR study had been finished showed that S2 did not have memory problems (See Appendix D). Nevertheless, he was dependent on his memory book and he obtained a score of 50% of the Prospective Memory Test (See Appendix C). S2 was also unable to work because of the serious consequences of his aneurysm. He has a High School Diploma and appears to have always maintained a keen interest in learning. S2 was 61 years of age at the time of the study and had an aneurysm of the right posterior cerebral artery six years previously. The aneurysm was of sudden onset, he suffered loss of balance, numbness and weakness on the left side of his lower body and he was left with residual left sided weakness and left hemianopia.

At the time of the study, S2, was restricted to using his right hand on the computer. While his hemianopia did not appear to affect his ability to work on the computer, it did make it more difficult for him to use the EO because he had to keep moving the EO so it was within his visual field. Neuropsychological tests were also done on S2 at the time of this study (See Appendix B).

Treatment of The Primary Question

The primary data were obtained from the Preinstructional - Postinstructional Assessment (PPA). This is a check list, based on a task analysis of the steps to open the CALENDAR section of the EO. and to enter tasks and set the alarm in the SCHEDULE section of the EO for specific dates and times. This is an observational based, functional behavioral assessment (See Appendix A).

Research Question 1:

> **Did the functional outcomes of the Preinstructional and Postinstructional Assessments demonstrate that the subjects learned how to use the Calendar and Schedule sections of the EO through the CACR program?**

The data for the PPA was a sequentially outlined, task analysis of the steps involved in opening the CALENDAR section, the steps involved in entering tasks, and setting the alarm for designated dates and times in the SCHEDULE section of the EO. These were obtained through behavioral observation of the subjects who were graded on the PPA according to each step that was performed.

For both the Preinstructional Assessment and the Postinstructional Assessment one point was given for each of the 13 steps for the CALENDAR and SCHEDULE tasks. Percent was calculated based on the correct score. This was not a timed task, but a maximum of five minutes was given because indications were that if the tasks were not accomplished within that time frame, it was unlikely that the subjects were going to succeed.

Reliability of PPA

Reliability of the PPA should be high because this assessment simply depended upon whether or not the Ss performed the designated task in the designated sequence. Also, test-retest reliability should be high because Unit 6, Exercise 6 was a computerized postinstructional assessment that was consistent with the Postinstructional Assessment. Therefore, because the results the Ss received for the Postinstructional Assessment were consistent with the results of Unit 6, Exercise 6, the test-retest reliability appears to be supported.

Validity of PPA

Validity requires that the test measures what it is supposed to measure. Given that the PPA was designed to measure whether or not the Ss performed the required steps in the required order to perform the designated tasks on the EO, the validity of this instrument should be good because the S either did or did not perform a certain task such as pressing the "ON" key.

Treatment of the Secondary Questions

There were two types of secondary data. The first was the computerized efficiency scores on the empirically based training procedures of spaced retrieval; the second, was the computerized efficiency scores for the technique of vanishing cues.

Research Question 2.1:

> **Did the efficiency scores of the subjects for the first time completion of Unit 3, Spaced Retrieval, Trials 1, 2, and 3 indicate that the subjects benefited from the technique of spaced retrieval (Schacter, Rich and Stampp, 1985) whereby the subjects improved their skill in locating and clicking the correct "keys" on the computer for finding a specific date in the SCHEDULE section of the EO?**

The three trials using spaced retrieval were separated by distractor tasks so that the same questions were presented on three different occasions and at repeatedly longer intervals through Unit 3.

The data that were needed for this question were the efficiency scores for the three identical exercises in Unit 3 which required the participants to locate and click the keys of the computerized drawing of the EO in the correct order for opening the SCHEDULE section of the EO.

The source of these data were the efficiency scores for Unit 3, Exercise 3 (1st run), Exercise 3 (2nd run), Exercise 3 (3rd run) of the EO CACR program. The efficiency scores were arrived at by dividing the number of seconds it took the subjects to do the the individual exercises, into the percent correct scores that were obtained. Therefore, the greater the length of time, the less the efficiency. These exercises were chosen because they were fundamental exercises in learning the order of the keys to open the SCHEDULE section of the EO.

These data were the efficiency scores that were complied and stored by the computer and accessed through the external data file of the EO CACR program which was accessed through the software package known as Excel. Efficiency scores are designed into the CACR program at the developmental stages whereby a calculation icon is used which reads as follows: "Efficiency:= (Percent/questime)*100". Percent is the percent correct score for a particular exercise and questime is the length of time spent doing that particular exercise.

These data were treated as follows:

i. A computerized printout of the efficiency scores for Unit 3, Exercise 3 (1st run), Exercise 3 (2nd run), and Exercise 3 (3rd run) was obtained from the external data file.

ii. The date, efficiency scores, percent correct and length of time spent on the exercise, along with the subject's name, were presented on a computerized printout for Unit

3, Exercise 3 (1st run), Exercise 3 (2nd run), and Exercise 3 (3rd run) and were presented in the form of a table which will be shown in the next chapter.

iii. In accordance with the research question, a comparison of the efficiency scores for Unit 3, Exercise 3 (1st run), Exercise 3 (2nd run), and Exercise 3 (3rd run),was made to see if the use of spaced retrieval enabled the participants to increase their skill on learning the correct sequence for "pressing" the keys to find a specific date in the CALENDAR section of the EO. This was determined by comparing the scores for Exercise 3 (1st run), Exercise 3 (2nd run), and Exercise 3 (3rd run) for each subject.

Research Question 2.2:

> **Did the efficiency scores of the first run of Unit 6, Exercises 2, 3, 4, 5, and 6 show that the subjects benefited from the technique of vanishing cues (Glisky and Schacter, 1987) whereby they learned how to: (1) open the SCHEDULE section for the designated date; (2) to set the time and alarm; and (3) correctly enter the prescribed tasks into the EO.**

The data that were needed for this question were the efficiency scores for the exercises on vanishing cues from Unit 6, Exercises 2, 3, 4, 5, and 6. The data collection for vanishing cues was obtained by programming the efficiency scores into the CACR and programming each exercise so these scores were automatically sent to the external file and accessed through the software package called Excel.

The source of these data is the efficiency scores for Unit 6, Exercise 2, 3, 4, 5, and 6 of the EO CACR program. The efficiency scores were arrived at by dividing the number of seconds, it took the subjects to do the the individual exercises, into the percent correct scores that were obtained.

These data were treated as follows:

i. A computerized printout of the efficiency scores for Unit 6, Exercises 2, 3, 4, 5, and 6 was obtained from the external data file.

ii. The date, efficiency scores, percent correct and length of time spent on the exercise were presented on a computerized printout for Unit 6, Exercises 2, 3, 4, 5,and 6 and were presented in the form of a table which will be shown in the next chapter.

iii. In accordance with the research question, a comparison of the efficiency scores for Unit 6, Exercises 2, 3, 4, 5 and 6 was made to see if the use of vanishing cues enabled the participants to increase their skill on learning how to use the SCHEDULE section of the EO.

Neuropsychological Assessment of Ss

Both subjects were given selected subtests of the Wechsler Adult Intelligence Scale - Revised (WAIS-R), the Wechsler Memory Scale - Revised (WMS-R), the WCST, the Complex Figure Test (CFT) and the draft Prospective Memory Test sent from Barbara Wilson to the researcher on May 24, 1993 through Mr. J. Evans, Higher Scientific Officer and Honorary Clinical Psychologist, Medical Research Council, Cambridge, England. (Appendix E).

The Research Protocol

The EO CACR program is intended for the Acquisition Stage of the three stage training program of Sohlberg and Mateer (1989a). However, this program differs from theirs because an EO is used instead of a written memory book.

At this point it should be noted that as far as Computer Assisted Cognitive Retraining is concerned, the emphasis here has to be on the word "assisted". This program is not intended as a "stand alone" training package. However, it could be used as such if the person forgot how to use the EO when they were no longer in the training program. As far as the initial training is concerned this should take place under the close supervision of a clinician and used as a means to enhance the development of the whole person. A copy of the five units of the EO CACR lessons which were used for this study may be found in the pocket of this thesis.

The Philosophy

Cognitive rehabilitation must be incorporated into a holistic approach and not just used as a tool to keep the client busy. After all, the ultimate goal of a good rehabilitation program must be to improve the person's quality of life and to reintegrate them back into the community whenever possible. The objective of this program is to teach neurologically impaired people with prospective memory deficits to use an EO as a compensatory memory device for their everyday memory needs.

The Electronic Organizer

The EO for which the EO CACR program was designed is the Sharp Electronic Organizer, Model ZQ-3000. It costs approximately $79.00 and it produces relatively large print on the screen. This is a basic EO so the person is not overwhelmed with too many features that are unnecessary and may cause confusion. This EO is the bottom of the Sharp line, it is light and small and was well received by the participants in the study.

Preparation

The EO was preprogrammed by the researcher so that the information the CACR asks the Ss to find in the EO had already been entered into the EO before the Ss started the CACR Units. They were then graded on their performance.

An example of one of the questions asked in the CACR session was: "What is the task that has to be done on Monday, June 10, 1994 at 10:00 AM?". The researcher had previously pre-programmed the EO schedule section for June 10th at 10:00 so that the task "Wash the car" would show on the screen. Then, the S was required to open the SCHEDULE section for the appropriate date and time and type "Wash the car" into the CACR program for evaluation. This is the basic principle that was used to teach the CALENDAR and SCHEDULE sections. It was found that this gave sufficient information to the Ss for them to then generalize the same technique for working with the other sections of the EO without having to be given CACR instruction.

The EO CACR program is comprised of five units so whether or not the learner is to advance to the next unit depends upon their success with the current unit. It was suggested that if the S got an average score of 80% or greater for each run on the sane unit for two consecutive sessions, then the S should be progressed to the next unit. However, the S should be returned to a lower unit if they are unable to demonstrate mastery of the higher level and it is particularly important that Unit 6 is successfully accomplished. That is why the S should stay on Unit 6 until they gain 100% correct. A typical lesson is reviewed below:

Typical Lesson

Because the purpose of rehabilitation is to develop the whole person to the fullest potential, the importance of interpersonal communication has been kept in mind along with training the person how to use an EO through the CACR program. Not only does injury to the brain disrupt the person's cognitive process but it creates difficulties in other areas and, often, it is no longer easy for that person to just have an ordinary conversation with other people. Therefore, spontaneous opportunities for communication should be capitalized on and the subject should not be left alone in isolation with the computer even if the program is a "stand alone" program.

The lessons were designed to cover a one hour period which included personal interaction between the S and the researcher. First of all, the researcher and the S worked together on a unit of the EO CACR program. Then, the S and researcher took a 10 minute coffee break together. Though this is not made obvious to the S, the purpose of the coffee break is to build rapport with the S as well as giving a rest from working with the computer.

For Units 1, 2, and 3 it was found that the Ss were able to run through the unit once before coffee and once again after coffee. However, Units 4 and 5 were more difficult. So a break was taken halfway through and then the subjects resumed where they left off.

Record Keeping

The researcher kept notes regarding any difficulties the S appears to have doing the CACR program in order to anticipate changes in the design of the lesson that needed to be made. For example, neither S was physically able to use the mouse to drag items across the computer screen but both were able to click with the mouse. This presented a problem with Unit 1, which was the introduction on how to use a computer. Therefore, upon observing this problem the researcher quickly withdrew all the items in the EO CACR program which required the Ss to drag items with the mouse.

The Five Units

This program has been divided into five Units which progressively increase in difficulty. The purpose is to progress the learner in a consistent manner which may involve doing as few as one run on each unit to several runs on the same unit if the subject is having difficulty and to facilitate learning efficiency.

The advantage to this approach is that EO CACR program has the flexibility to facilitate over-learning through repetition of the same unit until mastery has been achieved. The computer screen showed the percent correct scores and the time it took to do each exercise.

Unit 1

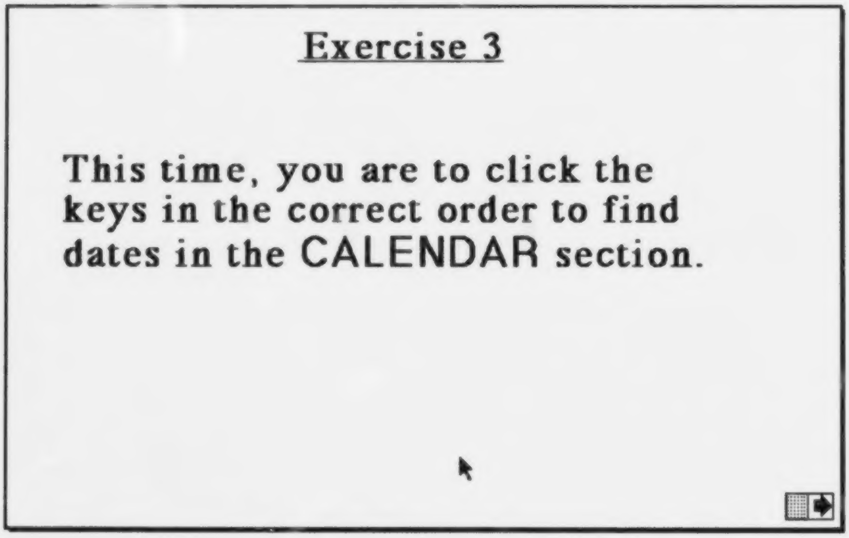
This is the introductory lesson and it taught the subjects how to use the computer. There are seven interactive exercises which involve teaching the subjects to find various keys on the computer key board and how to click with the mouse. Detailed instructions were built into Unit 1 on how to use the mouse and an option was given for instruction for right or left handed users.

Unit 2

This is the first unit which taught the subjects about the EO and it gave them simulated "EO exercises" in the CACR program. The EO keyboard is represented by diagrams which vary in format to facilitate generalization of learning to the EO, whereby emphasis is placed on the relative location of the keys.

There are twelve short exercises in this unit. The purpose was to present the Ss with a variety of different ways to learn the same information. Spaced retrieval was used in this unit whereby the S is required to click the "keys" on the diagram on the computer screen in the correct order to open the CALENDAR section of the EO. Because this is spaced retrieval, the exercise was repeated three times and the only change was that different dates were used for the questions.

Figure 1 EO CACR: Unit 3, Exercise 3, Frame 1



Exercise 3

This time, you are to click the keys in the correct order to find dates in the CALENDAR section.

Unit 3

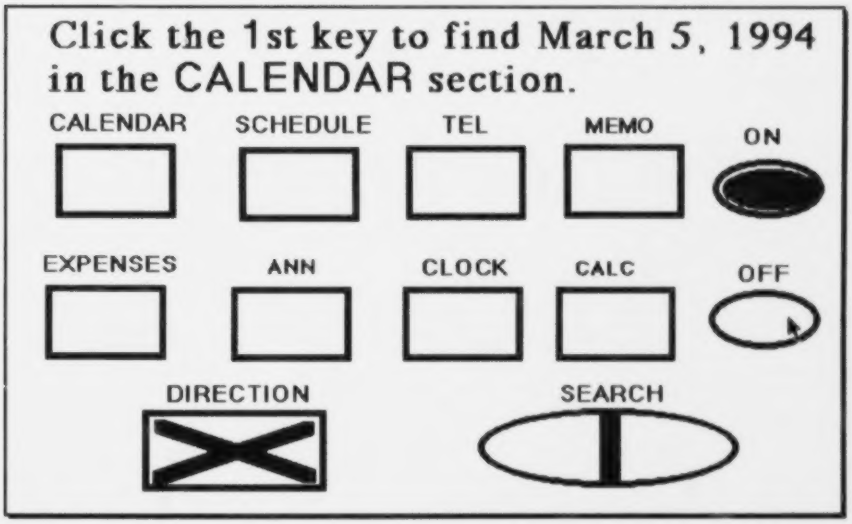
In this unit, the Ss were taught to actually use the real EO to find dates in the CALENDAR section. This also involved 12 short exercises and included questions on the names of the keys that are used to open the CALENDAR section. The technique of spaced retrieval was used in this unit.

Here is an example of the CACR spaced retrieval exercise which is repeated three times throughout Unit 3. The only difference on the second and third trials is that the date changes. Following are the frames from that exercise. It should be noted that the key that is to be pressed is shown in red in the diagram in the EO CACR. The reason is to increase the Ss awareness of the location of the appropriate key in relationship to the other keys.

The purpose of using a red key is to facilitate recall and success means that the Ss progressed to the next Unit,. Therefore, the person's intelligence was not insulted by repeatedly having to review the same exercise with the same keys. Meanwhile, if the Ss had problems with this exercise, the use of the red key would have been useful and repeated exposure to this lesson would have been necessary to facilitate learning. Consequently, in that case, the use of a red key would have been advantageous. As it was, both Ss did well.

Here is the first CACR screen for the spaced retrieval exercise and the learner is to click the ON key with the mouse. This key is in red and the EO CACR frames are shown below.

Figure 2 EO CACR: Unit 3, Exercise 3, Frame 3



Click the 1st key to find March 5, 1994 in the CALENDAR section.

Figure 3 EO CACR: Unit 3, Exercise 3, Frame 4

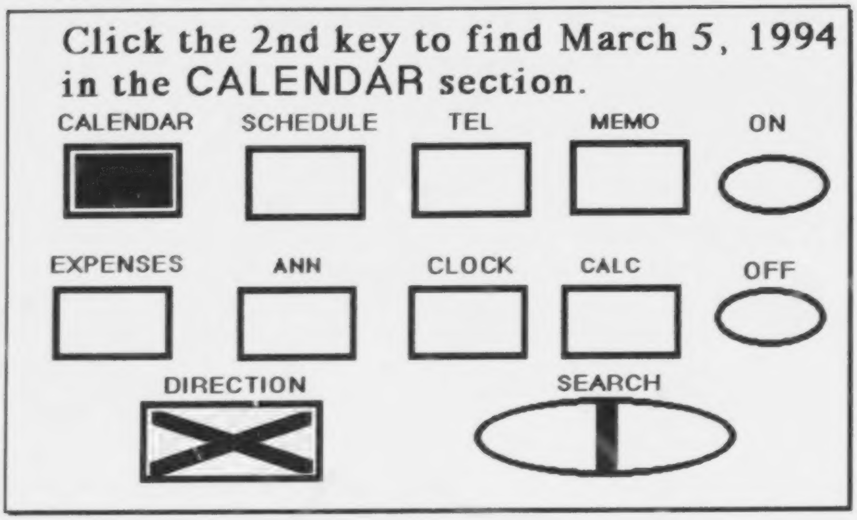
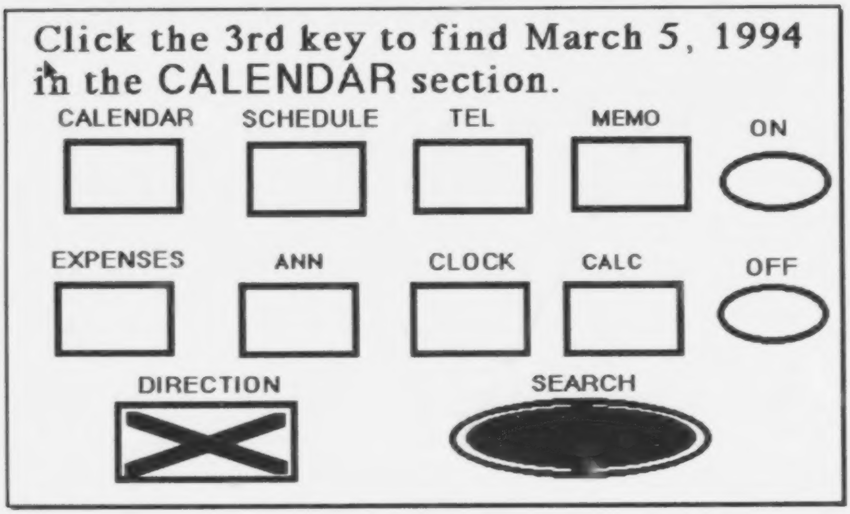
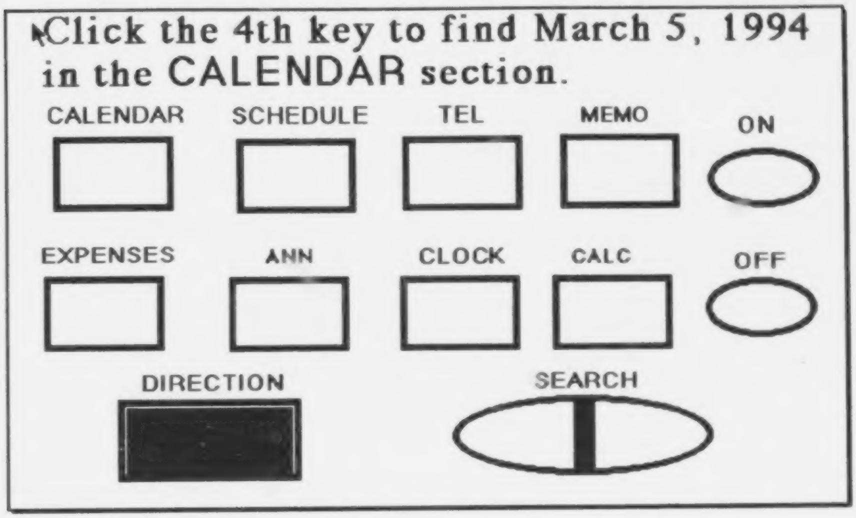

Click the 2nd key to find March 5, 1994 in the CALENDAR section.
CALENDAR
SCHEDULE
TEL
MEMO
ON
EXPENSES
ANN
CLOCK
CALC
OFF
DIRECTION
SEARCH

Figure 4 EO CACR: Unit 3, Exercise 3, Frame 5


Click the 3rd key to find March 5, 1994 in the CALENDAR section.
CALENDAR
SCHEDULE
TEL
MEMO
ON
EXPENSES
ANN
CLOCK
CALC
OFF
DIRECTION
SEARCH

Next, the DIRECTION keys have to be used to move the cursor to find the appropriate date of the month.

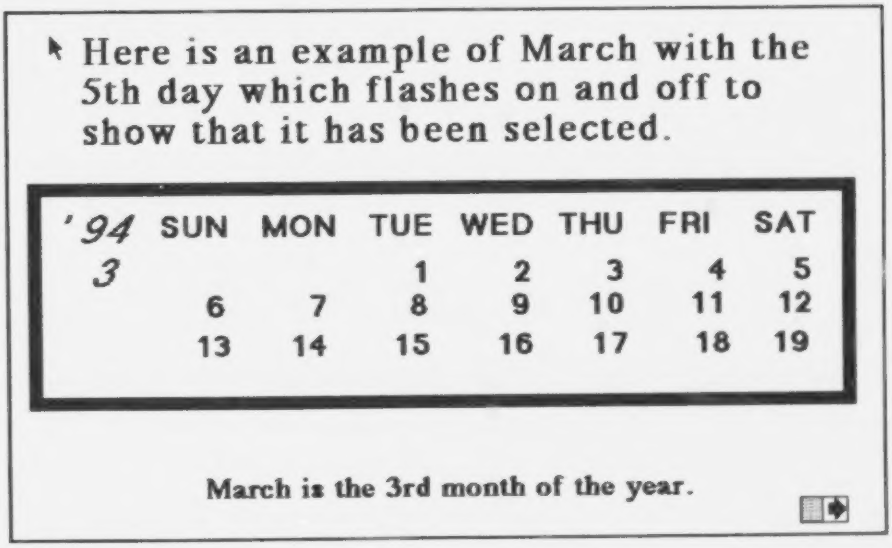
Figure 5 EO CACR: Unit 3, Exercise 3, Frame 6



Click the 4th key to find March 5, 1994 in the CALENDAR section.

CALENDAR
SCHEDULE
TEL
MEMO
ON
EXPENSES
ANN
CLOCK
CALC
OFF
DIRECTION
SEARCH

Figure 6 EO CACR: Unit 3, Exercise 3, Frame 7



Here is an example of March with the 5th day which flashes on and off to show that it has been selected.

'94	SUN	MON	TUE	WED	THU	FRI	SAT
3			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19

March is the 3rd month of the year.

Then, this spaced retrieval exercise is repeated two more times in Unit 3 and the only difference is that the S had to locate different dates in the CALENDAR section of the diagram of the EO.

Unit 4

This unit taught the Ss how to locate tasks in the SCHEDULE section of the EO. One exercise included the procedural task of clicking the keys in the right order, on the computer diagram, to open the SCHEDULE section. Other exercises involved actual use of the EO where the S had to locate specific tasks that were already programmed into the EO for specific dates. Then the Ss had to type those tasks into the CACR program. The technique of vanishing cues is used for this exercise.

Information had to to be put into the EO by the instructor before presenting the EO CACR program (See Appendix J). This was necessary because Exercise 7 of Unit 4 required the Ss to find specific information in the SCHEDULE section of the EO. Then, the Ss had to type this information into the CACR program for evaluation.

Unit 5

This unit used declarative learning such as asking the Ss to give the names of the various keys that have to be pressed to open the SCHEDULE section. It also required the Ss to type the times from the SCHEDULE section as shown on the diagram on the computer. Then the S was to open the SCHEDULE section of the real EO and type the tasks that are to be done on the specific dates as required.

Information also had to to be put into the EO by the instructor before presenting the EO CACR program (See Appendix J) because Exercises 2 and 5 of Unit 5 required the Ss to find specific information in the SCHEDULE section of the EO. Then, the Ss had to type this information into the EO CACR program for evaluation.

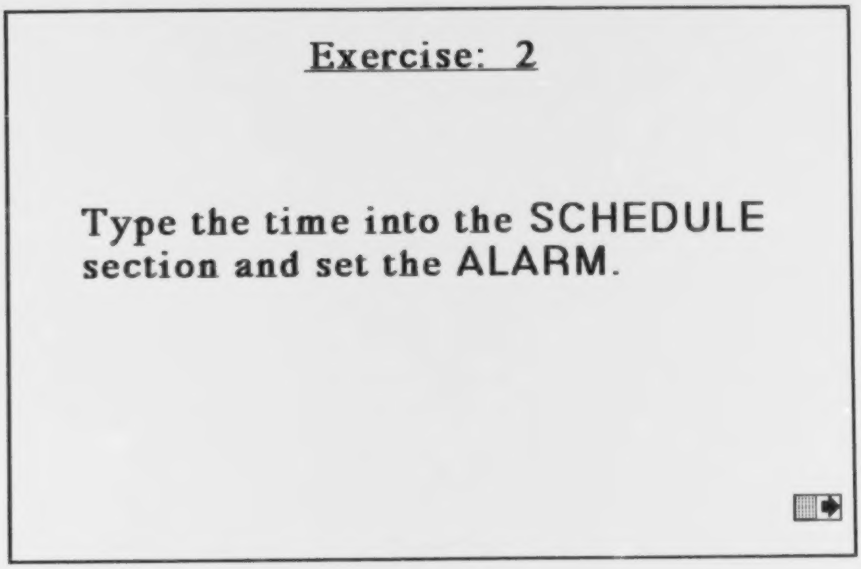
Unit 6

This was the unit where the technique of vanishing cues was used. This unit started off with a warm-up drill on clicking the keys to open the SCHEDULE section and then the Ss were instructed to type the time, set the alarm, and type tasks into the SCHEDULE section. All these requirements were accompanied by step-by-step instructions which were available on the computer screen as an option if they needed to refer to it. However, these cues were systematically phased out towards the end of the unit. Finally, the Ss were required to open the SCHEDULE section for the designated date, set the time, set the alarm and enter the tasks into the EO without any cuing from the computer.

The last Exercise in Unit 6 required the Ss to ask the instructor to give verbal directives about the date, times and tasks that the Ss were to enter into the EO. Thus, the systematic computerized instruction was phased out, and replaced by real-life EO tasks and the answers were still evaluated by the computer program under the supervision of the instructor. The technique of vanishing cues was used in this unit.

All the exercises in the EO CACR program automatically gave the date, efficiency scores, percent correct and length of time spent on each exercise were recorded in the external file. This file was accessed through Microsoft Excel. Next are some frames from a typical exercise which uses vanishing cues.

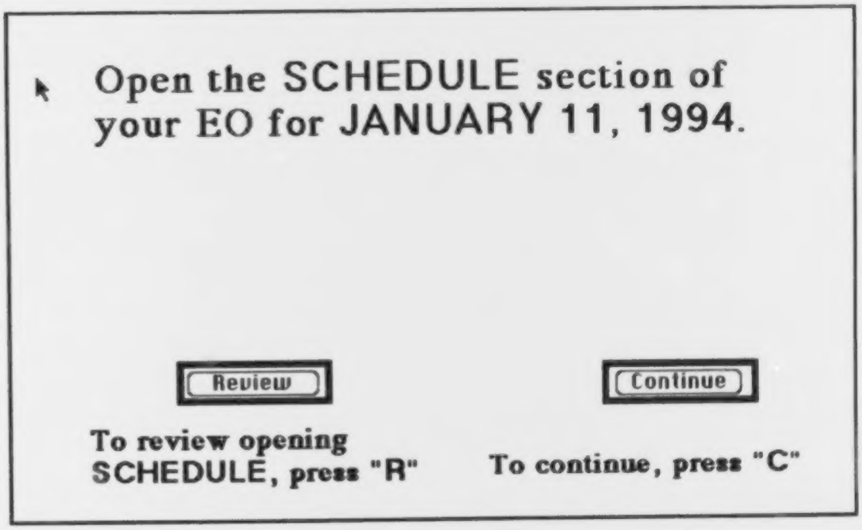
Figure 7 EO CACR: Unit 6, Exercise 2, Frame 1



Exercise: 2

Type the time into the SCHEDULE section and set the ALARM.

Figure 8 EO CACR: Unit 6, Exercise 2, Frame 2



Open the SCHEDULE section of your EO for JANUARY 11, 1994.

To review opening SCHEDULE, press "R"

To continue, press "C"

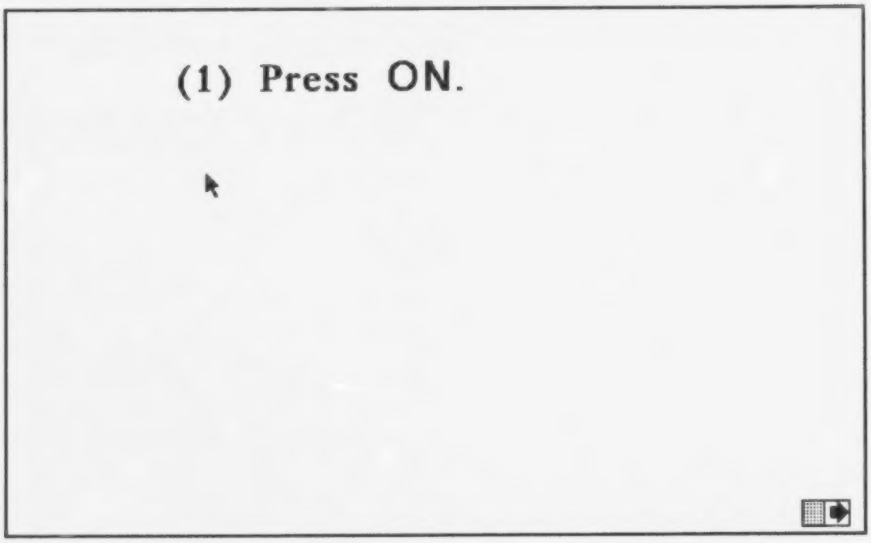
The exercise is then followed by the frame with the instructions and two choices are given. If the S is proficient in locating the specific date, they can immediately proceed to the next part of the question by clicking CONTINUE. If not, the REVIEW option will provide the information that is needed. However, because this is an exercise in vanishing cues, this was the last time the S got a chance to review this particular information for this run of the Unit.

If the S had repeated problems at this level, then they would have been put back to Unit 5 where this REVIEW step is taught. However. if the S met the criteria for completing Unit 5, which was as average of 80% on all exercises for two consecutive days, it would have been unlikely that it was necessary to drop back. But having the option to drop back to a lower level is the strength of the technique of vanishing cues and because CACR is on computer disks this change is easily accomplished.

This question gave the S two options. If the S remembered from Unit 5 how to open the SCHEDULE, then he pressed CONTINUE. However, if the S needed to see a step-by-step review of how to open the SCHEDULE section, then he pressed REVIEW. The sequence of these steps is shown in the following frames.

As the following shows, to avoid redundancy, only selected frames from the EO CACR program (Owen-Flood, 1994) have been presented. See Appendix I to view the entire EO CACR program.

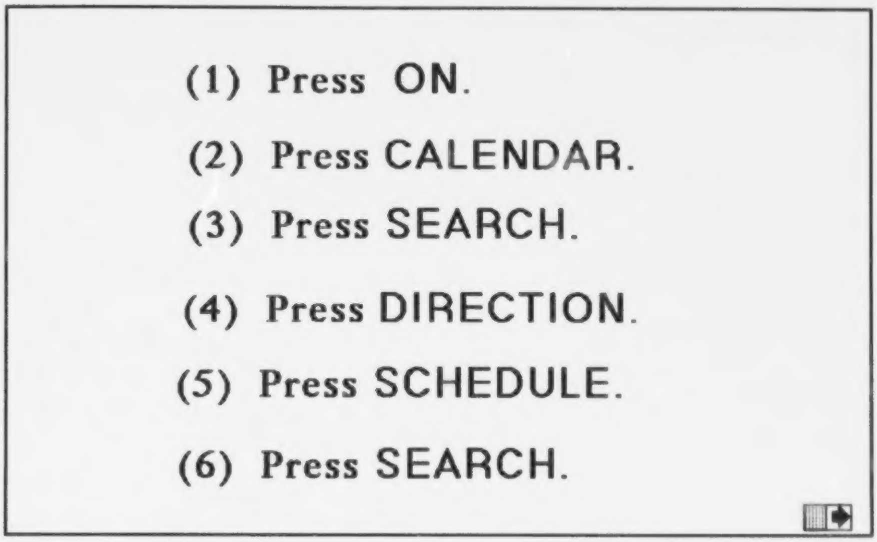
Figure 9 EO CACR: Unit 6, Exercise 2, Frame 3



(1) Press ON.

Then, the rest of the steps are added one frame at a time until the EO CACR screen looked like this.

Figure 10 EO CACR: Unit 6, Exercise 2, Frame 7



(1) Press ON.

(2) Press CALENDAR.

(3) Press SEARCH.

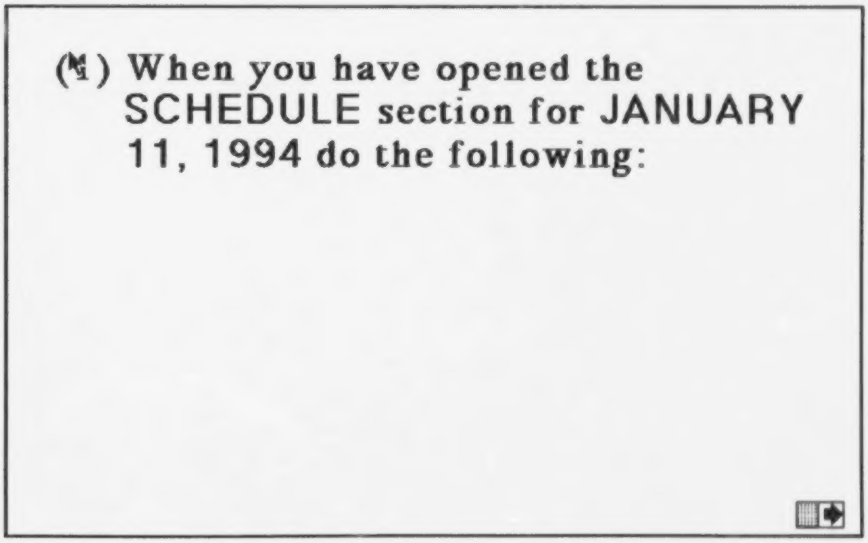
(4) Press DIRECTION.

(5) Press SCHEDULE.

(6) Press SEARCH.

The steps given above are the cues that the S could have accessed if they needed to do so. But if not needed. the S pressed CONTINUE which went straight to the following instructions. At this point it should be noted that if the S had not taken the REVIEW option, the CAI would have shown the following frame immediately after the instructions.

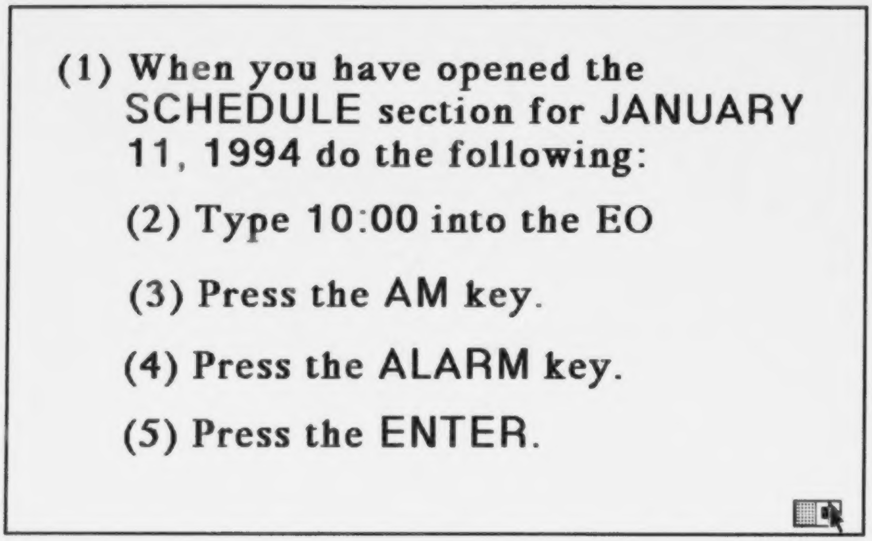
Figure 11 EO CACR: Unit 6, Exercise 2, Frame 8



(1) When you have opened the SCHEDULE section for JANUARY 11, 1994 do the following:

Once the S has found the date in the SCHEDULE section, steps are added until the screen looks like the following:

Figure 12 EO CACR: Unit 6, Exercise 2, Frame 15



(1) When you have opened the SCHEDULE section for JANUARY 11, 1994 do the following:

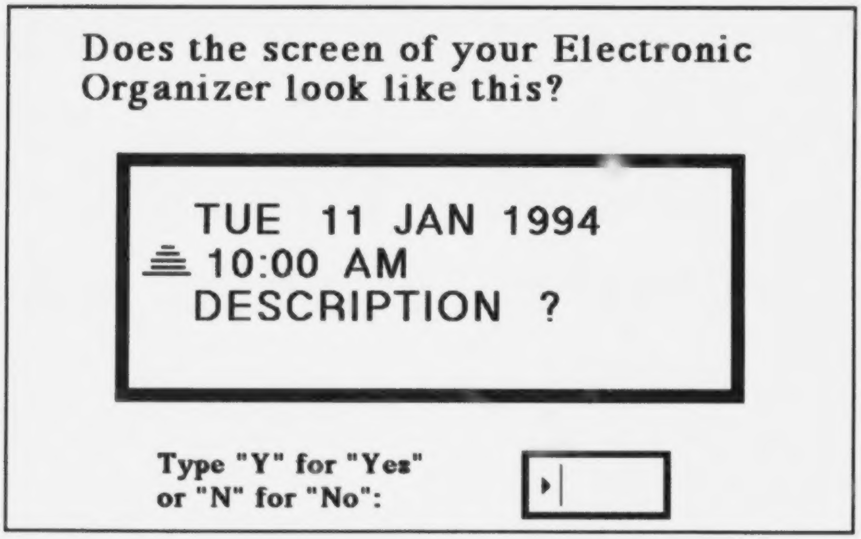
(2) Type 10:00 into the EO

(3) Press the AM key.

(4) Press the ALARM key.

(5) Press the ENTER.

Figure 13 EO CACR: Unit 6, Exercise 2, Frame 16



Does the screen of your Electronic Organizer look like this?

TUE 11 JAN 1994
10:00 AM
DESCRIPTION ?

Type "Y" for "Yes"
or "N" for "No":

Implementation

It is important to demonstrate that cognitive interventions are effective through controlled studies (Glisky and Schacter, 1986). This is where ecologically relevant generalization of computer programs has got to be demonstrated but this is an area where many previous computerized programs have fallen short. Fortunately, the computerized data collection provided an automatic, unbiased, systematic form of data collection by assessing generalization of the learning to the Ss' everyday life is of crucial importance. It was not possible to do this with a computerized data collection so a behavioral checklist, that is the Postinstructional Assessment was used.

Ecological Validity

For the EO CACR program to be ecologically valid, it was necessary that the Ss were able to generalize the learning they received from the CACR to independent and spontaneous use of the EO for their everyday life. Therefore, it is recommended that the Ss in the EO CACR program either buy an EO or are given an EO.

Generalization

Parenté & Anderson-Parenté (1990) refer to generalization as the trainable skills which the person is able to use in a different context. This is differentiated from transfer where certain skills are directly applicable to one task only. An example of generalization of learning is when the learner used the EO for their everyday needs. Whereas transfer of learning is when the person uses the EO in accordance with the requirements of the CACR program on one computer and then uses the EO on a different computer with the same CACR program but does not spontaneously use the EO for his daily memory needs in the natural environment.

Generalization has also been defined as a broad based spontaneous behavioral change across a wide range of conditions, circumstances and time frames (Stokes and Osnes, 1988). This is important and Mateer, Sohlberg and Crinean (1987) have attested to the significance of a paradigm shift away from the clinical management of memory programs to the use of assessment and treatment procedures that have ecological validity. This was the goal of the EO CACR program and S1 achieved this goal.

Routine visual checks during the training period, and on the five month post-instructional telephone follow-up S1 stated that he was still making continuous use of the EO.

Ethical Considerations

This research was approved of by the Ethics Committee of the Department of Adult, Career and Technology Education and their signed approval was obtained (See Appendix G). The General Faculties Council guidelines (University of Alberta, 1991) for research on human subjects was used to identify and elaborate on the ethical factors involved in this study (See Appendix H).

IV. PRESENTATION AND DISCUSSION OF RESULTS

The results of the study are presented and discussed in accordance with the primary and secondary research questions and the behavioral observations. Also, other test results and profiles of the Ss will be presented and the possible implications will be reviewed.

Because one volunteer lived in the city and the other lived out of town, attendance between the two subjects was unequal. S1 attended twelve sessions over a six week period but S2 was able to attend only five sessions over a five month period. His primary problem was that his residual cerebral deficits made it medically inappropriate for him to drive into the city during the severe winter conditions.

The Results of the Primary Data

The primary data answered the purpose of the study which was to determine the efficacy of the EO CACR program to teach people with cerebral lesions to use an EO as a memory assistive device.

Research Question 1

Did the functional outcomes of the Preinstructional and Postinstructional Assessments (PPA) demonstrate that the subjects learned how to use the Calendar and Schedule sections of the EO through the CACR program? Results S1: PPA

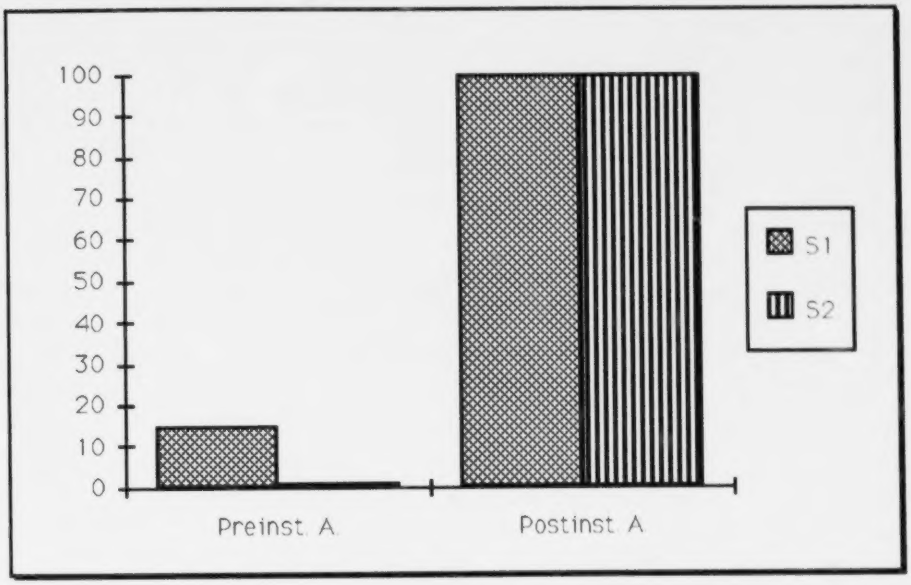
i. S1 succeeded in opening the CALENDAR section after several efforts but he was unable to open or enter data in the SCHEDULE section of the EO prior to the CACR program. Hence, he obtained a Preinstructional Assessment score of 15%.

ii. S1 learned how to use an EO through the CACR program whereby he was able to perform the required tasks for the CALENDAR and SCHEDULE sections in accordance with the PPA (See Appendix A). It should be pointed out that the only technique for teaching how to use the EO was through the CACR and verbalized instructions were not given for either the CALENDAR or SCHEDULE sections. S1 obtained 100% on the Postinstructional Assessment.

iii. S1, generalized the learning he gained from the CACR program by making successful use of the TIME, TELEPHONE and CALCULATOR sections of the EO and S1 stated that he was still using his EO five months later. Generalization was also demonstrated by his score of 100% on the Postinstructional Assessment which was a functional evaluation in the use of the EO and was totally independent of the CACR program.

iv. The Preinstructional and Postinstructional Assessments for S1 were eight weeks apart.

Figure 14 Pre & Postinstructional Assessment



The graph shown above is represented by the table that follows.

Table 1 Pre and Postinstructional Assessment

	S1	S2
Preinstructional Assessment	15	0
Postinstructional Assessment	100	100

Results S2: PPA

i. S2 was completely unable to use the EO prior to the EO CACR program as shown by the 0% percent he obtained on the Preinstructional Assessment.

ii. However, he did learn how to use an EO through the CACR program whereby he was able to perform the required tasks for the CALENDAR and SCHEDULE sections of the EO through the CACR program and his Postinstructional Assessment score was 100%.

iii. Generalization was also demonstrated by S2's score of 100% on the Postinstructional Assessment which was a functional evaluation in the use of the EO and was totally independent of the CACR program. Here it is meant that he generalized the learning from the CACR to independent use of the EO without cuing from any source. However, S2 did not use the EO for his everyday memory needs because he was not given an EO.

iv. The Preinstructional and Postinstructional Assessments for S2 were eighteen weeks apart.

However, he was not given an EO by the researcher so whether or not he would have used it for his everyday memory needs could not be determined.

In addition, the success of the functional Postinstructional Assessment for both subjects was supported by the computerized data collection for Unit 6, Exercise 6. This exercise required the Ss to enter information into the SCHEDULE section of the EO and both obtained 100% on this EO CACR task. Therefore, success in learning how to use the EO was verified on both the computer and through behavioral observation of the researcher.

As Table 1 shows, S1 did better than S2 on the Preinstructional Assessment because S1 was able to figure out the two steps to open the CALENDAR section. Initially S1 forgot to press the ON key before the CALENDAR key so he got a bit frustrated with himself for not thinking about that sooner. In contrast, S2 appeared to have greater difficulty generally and pressing the ON key never occurred to him at all.

On the informal observational assessment by the researcher S1 appeared to have delayed cognitive processing but, in spite of that, he demonstrated problem solving abilities. Delayed cognitive processing is typical following diffuse injury to the brain. Meanwhile, S2 who had a localized lesion, appeared to lack the same degree of problem solving abilities as far as figuring out how to open the CALENDAR section was concerned. Neither succeeded with the second task involving the SCHEDULE section. Opening the SCHEDULE section required several steps that had to be performed in the correct sequence. The ability to problem solve is an indicator of the intactness of the executive functional capacities and S1 was able to use this ability to open the CALENDAR section even though he, like S2, had never seen or used an EO before..

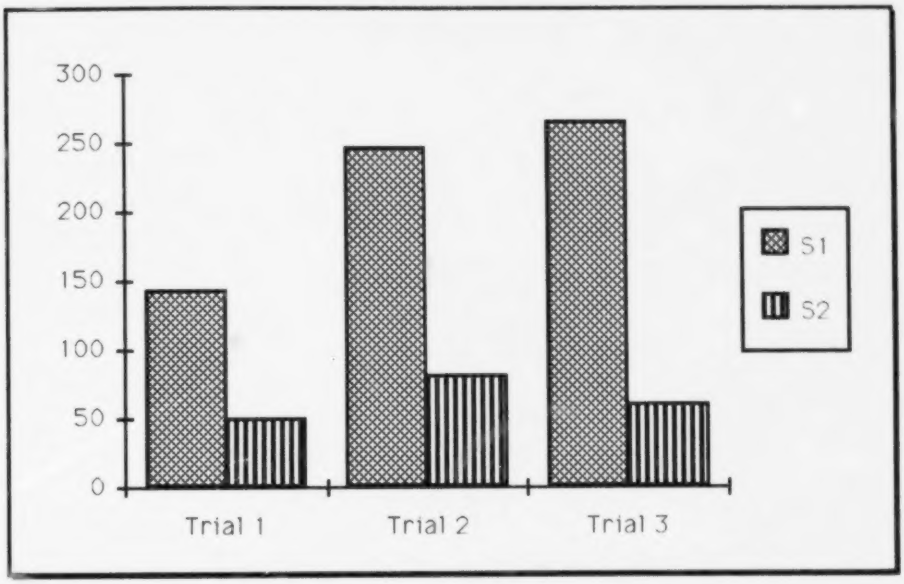
The Results of the Secondary Data

The secondary data addressed questions relating to the Ss cognitive abilities, their levels of executive function as indicated by the WCST and their ability to learn how to use an EO through the training techniques that have been designed into the program.

> **Did the efficiency scores of the Ss for the first time completion of Unit 3, Spaced Retrieval, Trials 1, 2, and 3 indicate that the Ss benefited from the technique of spaced retrieval (Schacter, Rich and Stampp, 1985) whereby the Ss improved their skill in locating and clicking the correct "keys" on the computer for finding a specific date in the SCHEDULE section of the EO?**

The graphs and tables below will present separately the efficiency scores, the percent correct and the time spent doing the exercises.

Figure 15 Spaced Retrieval - Efficiency Scores



The learning efficiency scores are shown graphically above and shown numerically below. The higher the efficiency scores, the more efficient the learning.

Table 2 Spaced Retrieval - Learning Efficiency

	S1	S2
Trial 1	142.55	49.14
Trial 2	246.61	80.46
Trial 3	265.25	59.23

Results S1: Spaced Retrieval - Learning Efficiency

The systematic increase of the efficiency scores suggested that S1 benefited from the training procedure of spaced retrieval which was designed into the EO CACR program. This also appears to have been supported by the Postinstructional Assessment referred to in the first research question whereby S1 had to know what keys to press and what order to press them in order to open the SCHEDULE section of the EO.

Results S2: Spaced Retrieval - Learning Efficiency

A disclaimer is necessary at this point with regard to the use of efficiency scores which are a performance measure. That is because in the case of S2 his motor problems and pain in his right arm interfered with his responding to the questions on the computer in a timely manner and, consequently, may have skewed the results. Therefore, it would have been better to have hypothesized learning effectiveness instead of learning efficiency and to have based learning effectiveness on the percent correct scores and the functional Posttinstructional Assessment (See Appendix A).

Percent correct for spaced retrieval will be presented next and it is interesting to see that both subjects scored equally well when graded on accuracy of response. Because of the disparity in the attendance between S1, who came regularly within a relatively short time period, and S2, whose sessions were spread out, one would not have expected such a good result from S2. However, unlike S1, S2 did not have memory problems according to the WMS-R yet he maintained that he could not function effectively without his memory book. S2 obtained a score of 50% on the Prospective Memory Assessment whereas S1 obtained 100% on the Prospective Memory test. These facts appear to support the findings of Meacham and Leinman (1982) and Wilkens and Baddeley (1978) who found that there is an absence of relationship between retrospective and prospective memory.

The spaced retrieval task in Unit 3 involved clicking the "keys" on the computer diagram in the CACR program and this was essentially a visual motor task. That was because the Ss had to use visual memory to find the relative locations of the "keys" of the EO and remember the correct sequence for clicking the "keys" with the mouse in order to open the SCHEDULE section for a specific date. This took five steps on the EO which had to be performed in the correct sequence.

Figure 16 Spaced Retrieval - Percent Correct

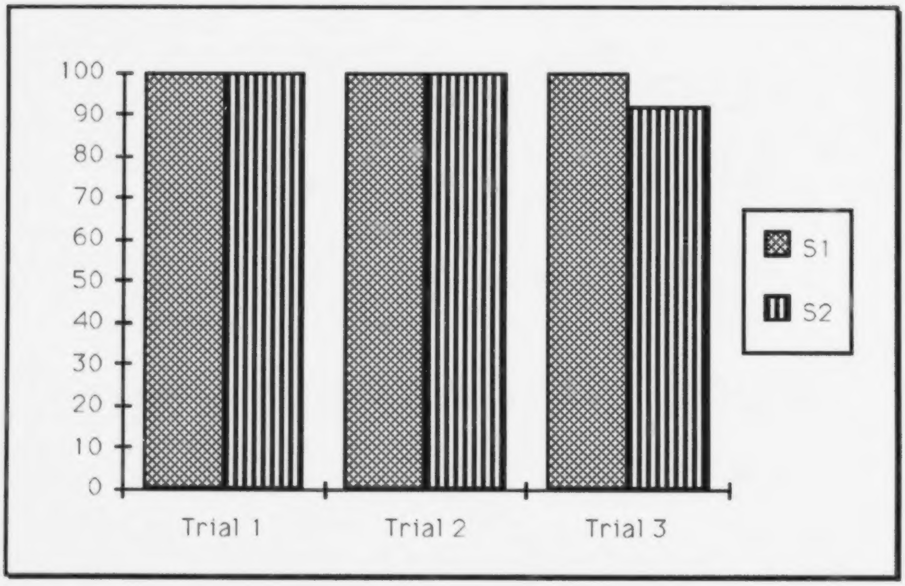


Table 3 shows the mild discrepancy whereby S2 obtained 91.67 for Trial 3 instead of a consistent 100% for the third run of the same exercise. This may have been due to fatigue or inattention.

Table 3 Spaced Retrieval - Percent Correct

	S1	S2
Trial 1	100	100
Trial 2	100	100
Trial 3	100	91.67

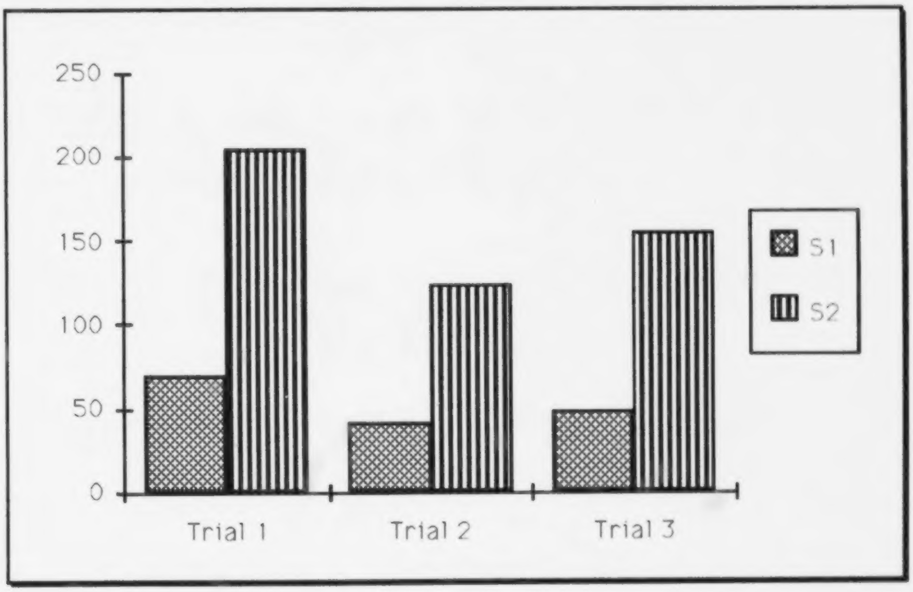
Results S1: Spaced Retrieval - Percent Correct

S1 obtained 100% accuracy on this spaced retrieval task and he anticipated where to click the mouse by placing it in the correct location before the computer changed to the next frame.

Results S2: Spaced Retrieval - Percent Correct

Unlike the learning efficiency, S2 's accuracy of performance is almost the same level as that of S1. This suggests that the discrepancy had more to do with S2's physical problems rather than his ability to learn. Next, the length of time it took each S to do the spaced retrieval exercises will be presented.

Figure 17 Spaced Retrieval - Time in Seconds



The numerical presentation in Table 4 provided the numerical data of the time in seconds. Understandably the first run took the greatest length of time because of learning the exercise and the second run took less time. However, the third run was longer than the second for both Ss so perhaps because of fatigue or physical limitations. Though it is the impression of the researcher that repetition facilitated learning, the increased length of time it took the Ss to complete Trial 3 indicates that caution must be used in determining the optimal number of repeat trials; a fourth trial would likely have shown even poorer results as far as length of time is concerned.

Table 4 Spaced Retrieval - Time in Seconds

	S1	S2
Trial 1	70	204
Trial 2	41	124
Trial 3	48	155

Results S1: Spaced Retrieval - Time

There is a relative decrease and then increase in the number of seconds required to do the exercise for S1 and the overall length of time he took to do this exercise is considerably less than that of S2.

Results S2: Spaced Retrieval - Time

S2 also showed a relative decrease in the length of time it took him to do the repeated trials of the same exercise. However, the number of seconds it took him was considerably greater than those of S1.

Indications are that spaced retrieval facilitated the cognitive processing of both S1 and S2 but especially in the case of S2, his scores are poorer than those of S1 and the delayed efficiency scores may have had more to do with his physical problems rather than his cognitive processing. Next, vanishing cues will be considered.

Recording the length of time spent doing the exercises can provide important information about the Ss's progress and, if excessive, would act as a flag for further investigation into decreasing learning ability which ought to be investigated. Delayed cognitive processing tends to accompany injury to the brain so the information on the length of time it takes to perform a task is more significant than it would be for normal populations.

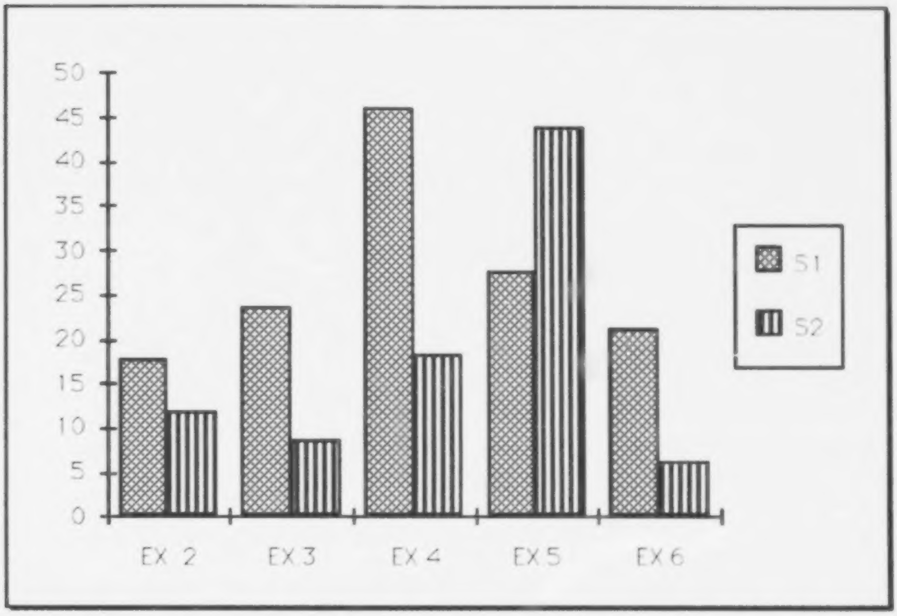
Research Question 2.2

> **Did the efficiency scores of the first run of Unit 6, Exercises 2, 3, 4, 5, and 6 show that the subjects benefited from the technique of vanishing cues (Glisky and Schacter, 1987) whereby they learned how to: (1) open the SCHEDULE section for the designated date; (2) to set the time and alarm; and (3) correctly enter the prescribed tasks into the EO.**

All the exercises in vanishing cues involve working with the actual EO and requirements for entering information into the EO get progressively harder towards the end of the Unit. That is because the cues are systematically reduced and the demands placed on the learner are systematically increased. Then, in the last exercise, instead of being given written information the Ss were given oral instructions from the researcher on the tasks they are to enter into the EO.

The spoken exercise in the last exercise was to ensure that the Ss could discontinue reliance on the cues and written information from the CACR program. However, the switch from written to oral communication represented an increase in cognitive demands. Fortunately, S1 did not have problems with working memory and S2 did not have retrospective memory deficits. So, this change in presentation did not affect either S.

Figure 18 Vanishing Cues - Efficiency



For increased clarity the number table is presented below for the efficiency scores for the vanishing cues exercises.

Table 5 Vanishing Cues - Efficiency

	S1	S2
Exercise 2	17.75	11.85
Exercise 3	23.66	8.61
Exercise 4	46.14	18.34
Exercise 5	27.53	43.92
Exercise 6	21.23	6.18

Results S1: Vanishing Cues - Efficiency

The variations in the efficiency scores that S1 obtained for Vanishing Cues showed peak efficiency at Exercise 4 and then the scores declined. The exercises in Unit 6 involved progressively increasing levels of difficulty along with the systematic reduction of cues for performing the task whereby the cues that had been provided in Exercise 4 had been completely eliminated from Exercise 5. The decreased efficiency rate at Exercise 5 may be related to the decrease in cues and no cues were given at all for Exercise 6 which is S1's lowest score. Exercise 6 was comprised of entirely verbal instructions given by the researcher instructing the Ss to put specific tasks into the EO for designated dates and times and set the ALARM. Consequently, Exercise 6 involved a major switch in presentation because there were no written instructions. Fortunately working memory was not one of S1's problems so he was able to retain the information long enough to perform the required task with the EO.

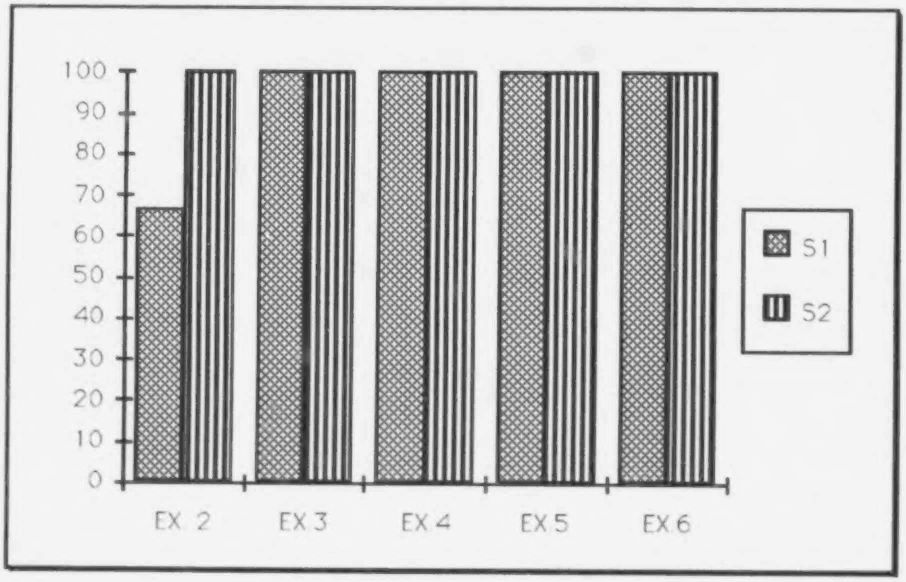
Results S2: Vanishing Cues - Efficiency

The learning efficiency scores for S2, seem to be somewhat inconsistent because he obtained the highest level of efficiency for Exercise 5, obtained approximately half that for Exercise 4 and got his second lowest score for Exercise 3. S2's poorest score is Exercise 6 which is an exercise where the task is presented in an entirely verbal approach. But he got 100% accuracy on this task so he attended to and remembered what he had to do.

One explanation that comes to mind is that Exercise 6 involved more steps. Therefore, his hemianopia and perhaps his topographical disorientation may have made it more time consuming for him to do this last exercise. No doubt there are a combination of factors and he also experienced intermittent pain in his left hand which appeared to become more pronounced when he became more tired towards the end of each training session. However, as the next graph shows, he still got 100% accuracy on this exercise.

Obtaining such high scores on Unit 6 was particularly significant because success in this Unit was the determining factor in the success or failure of the EO CACR program for each S. Fortunately, both did well and on an overall basis they got similarly high scores for accuracy which was important.

Figure 19 Vanishing Cues - Percent Correct



The vanishing cues - percent correct results show that S2 got 100% on all five exercises and S1 got 100% on four of the exercises.

Table 6 Vanishing Cues - Percent Correct

	S1	S2
Exercise 2	66.67	100
Exercise 3	100	100
Exercise 4	100	100
Exercise 5	100	100
Exercise 6	100	100

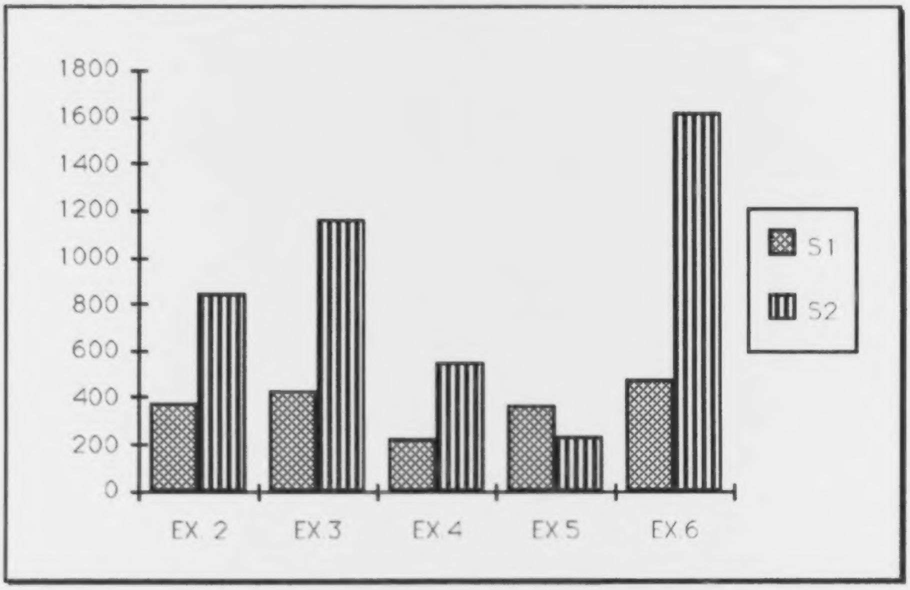
Results S1: Vanishing Cues - Percent Correct

Given that S1's normally received 100%, it is probable that his score of 66.67% is the result of transient inattention because it is not consistent with his overall level of performance.

Results S2: Vanishing Cues - Percent Correct

Here S2, got 100% correct every time. Therefore, his strong point is in the accuracy of his responses rather than his speed of performance.

Figure 20 Vanishing Cues - Time in Seconds



Given that both did well as far as accuracy is concerned, it is the results showing the time which provided interesting differences between S1 and S2.

Table 7 Vanishing Cues - Time in Seconds

	S1	S2
Exercise 2	376	847
Exercise 3	423	1162
Exercise 4	217	545
Exercise 5	363	228
Exercise 6	471	1617

Results S1: Vanishing Cues - Time

S1 was remarkably faster than S2 and this is probably due to the fact that his physical condition, while limited, was considerably better than that of S2

Results S2: Vanishing Cues - Time

These results on the length of time, make it clear that S2 took much longer to use the EO than did S1. However, it has to be remembered that S2's neurological insult involves the right posterior artery so he had hemianopia which meant he had to move the EO around in order to get it within his field of vision. The EO is considerably smaller than the computer screen and he had to get the light at the correct angle to read the EO. Also, S2 had topographical disorientation which has a motor component so perhaps this may have also contributed to the increased length of time it took him to complete the exercises.

Behavioral Observations of the Ss

Neither subject showed any obvious visual difficulties when working with the computer. But both had to make visual accommodation to see the EO.

S1, had presbyopia but did not have a correction to his glasses for reading because his physician felt that adjusting to bifocals would place him at increased risk for falling because of his brain injury. Therefore, he had to keep putting his glasses on to read from the computer screen and then take them off to work with the EO.

S2 had bifocals and kept his glasses on all the time. But his hemianopia made it difficult to read the EO. When he changed his focus from the computer screen to the EO, he kept moving the EO around in what appeared to be an effort to get the EO within his residual field of vision. He did not complain about his visual field deficits but the complications it caused him were apparent in his use of the EO.

Conclusion

The results of the PPA indicate that motivated people who have similar neurological insults and neuropsychological test scores (See Appendix D) to the Ss in this study can learn how to use an EO through the EO CACR program. However, conclusions could not be drawn about the efficacy of spaced retrieval and vanishing cues because theses techniques could not be separated from the overall success of the program.

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Prospective memory rehabilitation is a complex and challenging area. The increasing numbers of people surviving head injuries necessitates that cost-effective assistive devices be developed to meet the special needs of these individuals. The summary, conclusions, and recommendations for future research are presented below.

Summary

Prospective memory is multi-faceted, its component functions include metaknowledge, planning, monitoring, content recall, compliance and output monitoring. The EO CACR is designed to compensate for shortcomings in one or more of these areas. This study has investigated the efficacy of the EO CACR program to teach people with prospective memory deficits to make use of an EO as a compensatory prospective memory assistive device. This was single subject research which involved a comprehensive study of two participants. One S had CHI and the other had an aneurysm of the right posterior cerebral artery. Prior to the EO CACR program, both Ss were dependent on continuous use of a memory book and after the study, S1 abandoned his memory book and made continuous use of the EO but S2, who did not have an EO, continued to use his memory book.

The Preinstructional Assessment showed that neither S knew how to use an EO before the EO CACR program, whereas the Postinstructional Assessment showed that they were both successful in generalizing the CACR training to independent use of the EO without cuing from the CACR program. This indicates that the EO CACR program was successful.

The secondary research questions on spaced retrieval and vanishing cues suggested, based on the percent correct scores, that these techniques were effective. However, it was not possible to isolate the relative merits of one procedure over another but only possible to say that the EO CACR program was successful as a whole.

Conclusions

The conclusions are discussed below in accordance with the three research questions relating to the functional Postinstructional Assessment, spaced retrieval, and vanishing cues.

Postinstructional Assessment

The success of the EO CACR program was supported by the Postinstructional Assessment (See PPA, Appendix A) indicated that highly motivated people with either CHI or aneurysms of the right posterior cerebral artery whose scores are similar to those received on the neuropsychological tests (See Appendix D), by the Ss in this study, should be able to learn to use an EO through the CACR program.

Both Ss wanted to learn how to use a computer and to learn how to use an EO. However, S1 demonstrated a much keener interest in the EO than did S2. It is felt by the researcher that since S2 did not receive an EO, he did not have the advantages of constant reinforcement, and it is also felt that he would have overcome his visual problems through persistence.

One consideration which may have made S2 less interested in using an EO could have been his hemianopia. While he never complained, using the EO was more difficult for him because S2 had to keep moving it around to get the screen within his field of vision. S2's efficiency rate was much poorer than that of S1, and S2 had the added disadvantages of attending only five sessions over five months. Indications were that S2 had the money to buy an EO but he did not do so. Whereas S1 attended 10 EO CACR sessions over six weeks and he retained that learning over the five month period through continuous use of his EO as stated by him on the five month postinstructional telephone follow-up..

Parenté and Anderson-Parenté (1990) defined generalization as the achievement of a trainable skill which the person can use in a new or different context. Given that both Ss got 100 percent on the functional Postinstructional Assessment, both had the ability to generalize the training that they received from the EO CACR program for their every day memory needs. Generalization from the CACR lesson to independent use of the EO was demonstrated by the functional Postinstructional Assessment. However, evidence of use of the EO in the natural environment was shown by S1 only because he was given an EO. Therefore, it remains to be seen if S2 would have done the same if he had been given an EO.

Based on the data obtained from this research, indications are that people with neurological insult who have consistently made effective use of a memory book will do well using an EO to compensate for their memory problems. Also, people who are aware that they have memory problems and recognize the consequences that these deficits have on their everyday lives are more likely to put in the effort that is necessary to learn how to use an EO and follow through on that learning.

Efficiency Scores

In retrospect, efficiency scores were an inappropriate measurement criteria as they measured factors not relative to learning efficiency. It would have been preferable if the assessment of learning was based on the percent correct scores and the Postinstructional assessment which was a functional assessment.

Efficiency scores were chosen to assess learning proficiency because Raybould (1982) wrote that this was effective when assessing learning efficiency in children in special education classes. Children in special education classes have cognitive impairments that are somewhat similar to adults with cognitive impairments and many special education principles of instruction have been shown to be effective with adults. However, that is not to say that exactly the same approach should be used but that the same principles of instruction can be utilized but taking an adult format. For example, the three stage memory book training program of Sohlberg and Mateer (1989a) is based on the principles of special education. In precision teaching, learning is measured by the correctness of the response but also by the length of time it takes the person to get the correct answer. This is a behavioral principle whereby skill of acquisition is related to both accuracy and speed of information processing.

The efficiency scores exhibited less variability for S1 than for S2. But using efficiency scores to assess learning efficiency appears to have been a poor choice because of S2's hemianopia, the pain in his left arm and his topographical disorientation. These compounding factors may have been why S2 took so much longer to get the correct answers than S1 when doing the EO CACR program. Other considerations included increased fatigue and visual-motor problems. In retrospect, given that there were so many scores showing 100% in spite of his problems with efficiency, it is reasonable to assume that learning efficiency was not S2's real problem.

The Subjects

The contrasting case histories of the Ss in this study suggested that people with different types of neurological insults were able to benefit from the EO CACR program.

S1

S1 was very industrious, very organized and meticulous about planning ahead. He was an executive prior to his brain injury and his residual abilities in this area were apparent in his industrious approach to learning and his enthusiasm to learn how to use an EO. In spite of his memory problems which compromised the ability to learn new things (Lezak, 1987), S1 eagerly succeeded in learning how to use the computer, and how to use the EO. S1 was entirely successful in learning to use the EO and maintaining continuous use of the EO for his everyday memory needs five months after the CACR program had been completed.

S2

S2 did not demonstrate memory deficits on the Wechsler Memory Scale (See Appendix D). Nevertheless, he was very dependent on the use of his memory book which was bulky and he carried it with him everywhere he went. S2 said on a number of occasions that if he does not write things in his memory book immediately, he forgets what has to be done. On a number of occasions, S2 complained that since his aneurysm, he found that he had difficulty initiating activity.

While S2 did learn how to use the EO, he did not buy one and said that he found the memory book to be adequate for his needs. The problems demonstrated by S2's efficiency scores showed that he had considerably more problems using the EO than did S1 and this may have related to his compounding physical and visual problems but that cannot be clearly ascertained. But, in the final analysis, whether or not he was the ideal candidate for the research because of his physical problems, having S2 in the study proved to be an invaluable experience and because this study involved ongoing memory rehabilitation, like all rehabilitation situations, one works with the people one gets. As Wilson and Patterson (1990), the therapist has to work the deficits of the patient OTM (of the moment) and this is particularly so with volunteers.

Zencius, Wesolowski and Burke (1990) wrote that the following questions on memory rehabilitation need to be answered:

i. What strategy works and for what type of deficits?

ii. Are people with injury to the brain able to generalize these techniques?

iii. How long are these techniques maintained for their daily life after training has been completed?

According to the results of the EO CACR study, the answer to the first question is that EOs are an effective memory assistive device for prospective memory deficits. The second question related to generalization of training and the two Ss in this study were able to generalize the EO CACR training to independent use of the EO without being cued by the CACR program. Finally, the answer to the third question is clear cut as far as S1 is concerned because post-instructional follow-up showed that five months later he was still making continuous use of his EO on a continuous basis.

Recommendations for Future Research

The successful but limited outcome of this study combined with the well documented need for cost efficient, efficacious cognitive rehabilitation programs to assist people with their everyday memory needs, supports the need for EO CACR study to be followed by a more extensive study involving larger numbers of people who have prospective memory deficits.

Now that the EO CACR program (Owen-Flood, 1994) has been designed, the diskettes could be sent to practitioners in various rehabilitation centers for inclusion in the research programs that clients are already engaged. In the case of executives who are may have been skilled in the use of an EO before injury to the brain, such people would be ready candidates for retraining in the use of an EO after their injury. Training in the use of the EO should be given to people regardless of age or type in injury if they are genuinely interested in learning how to use it.

As de Wall, Wilson and Baddeley (1994) stated, memory deficits are the result of a wide range of diseases. Therefore, further studies using the EO CACR program should be done on a wide range of people with various neurological deficits. For example, healthy seniors could be trained to use an EO, while their memory is intact, so they are already skilled in its use before they developed memory problems. Dobbs and Rule (1987) stated that older peoples' failure to use memory aids may be due the absence of instruction in their use or failure to appreciate the potential of external memory devices. To offset this problem, the period for optimal training in the use of an EO would be before memory problems developed. Moreover, with the growing use of EO's combined with adequate instruction through the EO CACR program, the obstacles referred to by Dobbs and Rule could be overcome. This way, interested seniors could be skilled in using an EO before memory problems developed with the aging process.

The anecdotal evidence of S1 lends support to the above. About two months after the completion of the EO CACR program, S1 developed transient attacks which were thought to be epileptic seizures. He reported that after these attacks had passed he did not know who he was or that he had a wife, two daughters and a dog. He told the researcher that when he recovered from these episodes, he automatically reached into his pocket for his EO and opened the TELEPHONE section because reading the list of names reoriented him as to who he was.

When S1 was asked if the loss of memory which accompanied these attacks affected his ability to remember how to use the EO, he said "no" because he had used the EO so often that it was automatic so he did not have to remember how to use it. Given that using the EO is primarily a procedural learning task, his observation is quite correct.

S1 has apparently experienced some additional medical setbacks since he was in the program but his comment about his neurological problems and the EO related to the statement of O'Connor and Cermak (1987). They said that the problem with current retraining methods is that they expect the person to learn things they could not do before the trauma. More research needs to be done and the current advances in the area of multimedia should be utilized to facilitate prospective memory rehabilitation and make cognitive rehabilitation directly relevant to the person's individual needs. For example, video's could be taken of the person's home and incorporated into individually designed prospective memory rehabilitation training programs to increase ecological validity and make the CACR more meaningful to the person who has sustained injury to the brain. There are many types of cognitive dysfunctions or neurological insults which can result in memory problems. Therefore, the EO CACR program should be tested on a variety of populations.

In 1978, Parsons & Prigatano wrote that cognitive remediation was on the cutting edge of research. In 1986, Glisky, Schacter and Tulving wrote that a task for future research would be to train people with injury to the brain to use a computer to facilitate independence in the activities of daily living. In 1994, the continuous use of the EO five months after completion of the EO CACR program indicated that this goal has been accomplished for S1 and it is the researcher's hope that other people will benefit accordingly.

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APPENDIX A

Preinstructional - Postinstructional Assessment

Preinstructional - Postinstructional Assessment

Directions: Give one point for each step that is performed in the right sequence. The participant is to be assessed on the ability to open the CALENDAR and the SCHEDULE section. Then, the scores are to be added and divided by 13 to obtain the percent correct. A maximum of 5 minutes is suggested to perform these tasks.

The task analyses for opening the CALENDAR section for today's date was as follows:

STEP **POINTS**

Step 1: Press the ON key ______
Step 2: Press the CALENDAR key ______

The task analyses for opening the SCHEDULE section for entering a task and setting the alarm for a specific date and time was as follows:

Step 1: Press the ON key ______
Step 2: Press the CALENDAR key ______
Step 3: Press the SEARCH keys for the month. ______
Step 4: Press the DIRECTION keys for the date ______
Step 5: Press the SCHEDULE key for the date ______
Step 6: Type in the time into the EO ______
Step 7: Press AM or PM as required ______
Step 8: Press ALARM ______
Step 9: Press ENTER ______
Step 10: Type in the TASK into the EO ______
Step 11: Press ENTER ______

Total Score: ______

Percent Correct ______

APPENDIX B

Consent Form

Prospective Memory Rehabilitation:

Electronic Organizer Training through Computer Assisted Cognitive Rehabilitation

Consent Form

Prospective Memory Rehabilitation: Electronic Organizer Training through Computer Assisted Cognitive Rehabilitation

As you know, memory problems are a frequent consequence of injury to the brain and it is necessary to find effective ways for dealing with this problem. We want to assess whether training in the use of an Electronic Organizer can be of assistance in helping people cope with this type of deficit.

You will be trained to use an Electronic Organizer through the use of a computer training program and individualized instruction. This training program will take place at the University of Alberta, Faculty of Education, Room 734, Education South. Subject to the individual needs of the participant, the tentative training period will be on a daily basis between November 8 - December 17, 1993.

Confidentiality will be maintained and a number will be used instead of your name. Deception will not be used and there are no risks involved in this study. However, it will be necessary to do an initial pre-screening assessment in order to select the appropriate participants. Therefore, we are also asking you to sign for the release of the following data from your neuropsychologist:

1. Glasgow Coma Score
2. WAIS - R
    - Verbal IQ
    - Performance IQ
    - Full Scale IQ
3. Wechsler Memory Score - Revised
    - Paragraph Recall
        - Immediate
        - Delay
4. Boston Card Sorting Test
5. CT Findings

You are free to withdraw now or at any time during the study. However, if ;you need additional information regarding this research it can be obtained from Jill Owen-Flood (432-0346), Masters Candidate, or Dr. M. Szabo (492-0715), Professor, Department of Adult, Career and Technology Education, University of Alberta.

I have read the above information and agree to participate in this study.

Signature of Participant Date

Signature of Guardian Date

Signature of Witness Date

Signature of Investigator Date

APPENDIX C

Prospective Memory Assessment (draft)

The following Prospective Memory Assessment has been designed by Barbara Wilson and is presented below without any changes from the copy she sent me.

Prospective Memory Assessment (draft)

Begin, "During this session you will have a number of tasks to work on. In total the session will last 20 minutes. Occasionally you will also be asked to remember to do certain other tasks either during the session or at the end. When you are asked to remember to do something you are free to use any strategy you like to help you to remember. You can make use of any of the things here on the desk or anything else you wish.

1. We will start now (note time on clock/stopwatch). The first thing I am going to ask you to remember is that towards the end of the 20 minutes (sometime in the last 5 minutes) I would like you to remind me not to forget my keys. You can just say "don't forget your keys." *Keys should be on a table/surface somewhere near.*

2. The next thing I am going to do is hide 5 objects around the room and when I tell you that the testing is over I would like you to remind me that I have hidden these objects and to try to remember what they are and where they are hidden.

3. The next thing I am going to do is to set this alarm to ring in 5 minutes time. When it rings I would like you to go and switch on (or off) the room lights."

4. *Start on Coloured Matrices*

5. *After patient has done two/three matrices, say*, "when you have done two more of these I would like you to ask me to give you the newspaper/magazine."

6. *Continue with Matrices and go on to HAD if necessary.*

7. *After the 5 minutes alarm has gone off give the patient the note and message envelope which ways* "Here is another task for you to remember. When you hear the tester tell you that you have five minutes left in the test, please give him/her the message envelope. You do not have to say anything at that time, just pass the message envelope over." *If the patient cannot read, then this can be read out to them.*

8. *Remember to say* "5 minutes left" *on time.*

9. At 20 minutes say, "that's the end of the test now". Wait to see if the patient remembers that the objects have been hidden. If no (after 30s) say "Can you remember that I hid some things at the beginning of the test?' If patient then says "yes", but still does not remember that they have to tell you what they were and where they are, then say, "Can you remember what they were and where they were hidden?'

Prospective Memory Assessment - S1

Name of patient: S1

Age of patient: ....41..................................

Sex of patient: ....M.................................

Diagnosis: Closed Head Injury...............................

Time since insult: 8 years..

Current IQ (If not available see below): ....n/a......................

Estimate of pre-morbid IQ (please tick in one box):

Rough estimate of pre-morbid IQ (please tick in one box)

Below Average	**Average X**	**Above average**

Rough estimate of current IQ (please tick in one box)

Below Average	**Average X**	**Above average**

Prospective Memory Test

1. **Did the subject remember to mention the keys in the last five minutes? If not describe what happened.**

   Yes, the subject remembered the keys. (Points = 20/20)

2. **Did the subject remember to mention the objects at the end and then find them all? If not describe what happened.**

   The subject remembered to mention the objects, knew where they were and got 4 of the 5 objects correct. (Points = 15/20)

3. **Did the subject remember to switch on/off lights after five minutes? If not describe what happened.**

   Yes, the subject remembered to switch on/off the lights (Points = 20/20)

4. **Did the subject remember to pass over the newspaper after doing 2/3 matrices? If not describe what happened.**

   Yes, the subject remembered to pass over the newspaper. (Points = 20/20)

5. **Did the subject remember to pass over the message envelope with five minutes left? If not describe what happened.**

   Yes the subject remembered to pass over the message envelope.(Points = 20/20)

Please describe any strategies used by the subject to help them remember:

S1 is fully aware of his memory problems and his need to compensate so he carefully wrote down what he had to remember and systematically checked his list to monitor the time and perform the right tasks at the right time.

Percent Correct = 95%

Prospective Memory Test - S2

Name of patient: S2

Age of patient: ....61 years.......................................

Sex of patient: ....M....................................

Diagnosis: .Aneurysm of right posterior..cerebral artery........

Time since insult: ....7 years...

Current IQ (If not available see below): ....n/a..............

Estimate of pre-morbid IQ (please tick in one box):

Rough estimate of pre-morbid IQ (please tick in one box)

Below Average	**Average X**	**Above average**

Rough estimate of current IQ (please tick in one box)

Below Average	**Average X**	**Above average**

Prospective Memory Test

1. **Did the subject remember to mention the keys in the last five minutes? If not describe what happened.**

   No. He forgot about them completely. (Points = 0/20)

2. **Did the subject remember to mention the objects at the end and then find them all? If not describe what happened.**

   Yes and he got all 5 objects correct. (Points = 20/20)

3. **Did the subject remember to switch on/off lights after five minutes? If not describe what happened.**

   Yes, he remembered the lights, but he turned them off 5 minutes too early. (Points = 10/20)

4. **Did the subject remember to pass over the newspaper after doing 2/3 matrices? If not describe what happened.**

No. The subject forgot to pass over the newspaper after doing 2/3 matrices.
(Points = 0/20)

5. **Did the subject remember to pass over the message envelope with five minutes left? If not describe what happened.**

Yes, the subject did remember to pass over the message envelope.
(Points = 20/20)

Please describe any strategies used by the subject to help them remember:

S2 wrote down all tasks that he was told to do at the time he was told to do them. However, with some of them, he forgot to look at his notes.

Percent Correct = 50%

Prospective Memory Test (Score Sheet)

Age of patient: ....

Sex of patient: ....

Diagnosis: ....

Time since insult: ....

Current IQ (If not available see below): ....

Estimate of pre-morbid IQ (please tick in one box):

Rough estimate of pre-morbid IQ (please tick in one box)

Below Average	**Average**	**Above average**

Rough estimate of current IQ (please tick in one box)

Below Average	**Average**	**Above average**

Prospective Memory Test

1. Did the subject remember to mention the keys in the last five minutes? If not describe what happened.

2. Did the subject remember to mention the objects at the end and then find them all? If not describe what happened.

3. Did the subject remember to switch on/off lights after five minutes? If not describe what happened.

4. Did the subject remember to pass over the newspaper after doing 2/3 matrices? If not describe what happened.

5. Did the subject remember to pass over the message envelope with five minutes left? If not describe what happened.

Please describe any strategies used by the subject to help them remember:

APPENDIX D

Neuropsychological Test Results

Neuropsychological Test Results - S1 (March 1994)

Time post-injury: 8 years & 6 months Age:
44 years
Education: Grade XII Etiology: Motor Vehicle
Accident

Test	Impairment	Percentile
WAIS - R		
Arithmetic		37
Similarities		75
Picture completion		63
Digit Symbol	Moderate	5
WMS - R		
Digit Span		
Digits forward		16
Digits backward	Severe	<2
Visual Memory Span		
Tapping Forward		31
Tapping Backward		66
Logical Memory		
Immediate Recall		
Story A Recall:		
Story B Recall:		
Total:		26
Delayed Recall		
Story A Recall:		
Story B Recall:		
Total:		37
Visual Reproduction		
Immediate Recall		
Card A Total: :		
Card B Total		
Card C Total:		
Card D Total :		
All Cards Total:	Moderate	4
Delayed Recall		
Card A Total :		
Card B Total :		
Card C Total:		
All Cards Total:	Mild	9
WCST		
Preservative errors		39
Perseverative responses		45
Categories:		>16
CF *		
Copy:		45
Recall at 30 minutes	Mild	9

Neuropsychological Test Results - S2 (May 1994)

Time post-injury: 2 years & 2 months
Age: 61 years
Education: Grade XII Etiology: Aneurysm of right posterior
cerebral artery

Test	Impairment	Percentile
WAIS - R		
Arithmetic:		25
Similarities:	severe	<2
Picture completion		50
Digit Symbol		25
WMS - R		
Digit Span		
Digits forward:		37
Digits backward:		85
Visual Memory Span		
Tapping Forward:		37
Tapping Backward:		49
Logical Memory		
Immediate Recall		
Story A Recall		
Story B Recall		
Total:		27
Delayed Recall		
Story A Recall		
Story B Recall		
Total:		29
Visual Reproduction		
Immediate Recall		
Card A Total		
Card B Total		
Card C Total		
Card D Total		
All Cards Total:		33
Delayed Recall		
Card A Total		
Card B Total		
Card C Total		
Card D Total		
All Cards Total:		31
Wisconsin Card Sorting Test		
Preservative errors:		58
Perseverative responses :		63
Categories:		>16
Complex Figure		
Copy		45
Recall at 30 minutes		25

APPENDIX E

Discussion of Neuropsychological Tests Results.

As Diller and Gordon (1981) indicated, the time has passed for arguing whether therapies work and we must put our energies into understanding what therapies work best for which types of clients. However, neuropsychological assessments is one of the most readily available and is the primary, universally accepted technique for assessing neuropsychological impairments.

Therefore, this type of assessment should be obtained. Then perhaps if this study is eventually run on approximately one hundred subjects, there is the possibility that there may be clusters of neurospychological subtests that may be consistent with whether or not particular individuals either succeed or fail in the use of the EO CACR program.

Because of the importance of establishing evidence of lesions to the brain and to determine the cognitive status of the subjects with regard to memory, neuropsychological assessments were performed. These were selected subtests of the Wechsler Adult Intelligence Scale - Revised (WAIS-R), the Wechsler Memory Scale - Revised (WMS-R), the Complex Figure Test (CFT), the Wisconsin Card Sorting Test (WCST) and the draft version of the Prospective Memory Test (PMT). A full battery was not performed but only those tests which were necessary to provide evidence of cognitive and memory deficits. The profiles of all the subtests for each subject are included in the Appendix.

The scores shown below have been normed for years of education and for age. Because the mean for percentiles is always the 50th percentile, the mean has not been shown in these tables. Also, one standard deviation on either side of the mean is considered as being within normal limits so scores that fall between the 16th percentile and the 84th percentile are within the normal range.

WAIS-R: Discussion of Results

Lezak (1983) writes that low scores on the auditory subtests can relate to problems with concentration, immediate memory, tracking or conceptual manipulation. Arithmetic and Similarities are verbal subtests whereas Picture Completion and Digit Symbol are performance subtests. The results of the WAIS-R are quite different for both subjects as is shown on the table below:

Table 8 WAIS-R Percentile Scores

Subtest	S1	S2
Arithmetic	37	25
Similarities	75	<2
Picture Completion	63	50
Digit Symbol	5	25

S1

All percentile scores for this subject are within normal range except Digit Symbol which is sensitive to brain injury. Lezak (1983) writes that this is a timed subtest and is affected by attentional deficits, memory and speed of information processing. Also low scores on Digit Symbol become evident regardless of whether the injury is diffuse or lateralized.

S2

All S 2's scores are within the normal range except for the Similarities subtest. Kaufman (1990) wrote that low scores on Similarities are consistent with bilateral frontal lobe damage but not when it is only the right frontal lobe that is involved. Lezak recommends the Similarities subtest for assessing the examinee's level of general intellectual ability and points out that low scores are indicative of concrete thinking. Concrete thinking is a low level of cognitive process whereby the person is unable to draw inferences from the information that is presented. S2 had severe problems with this subtest.

WMS-R: Discussion of Results

The WMS-R is not a prospective memory test but it is important because it is widely used and deficits in retrospective memory tend to be accompanied by deficits in prospective memory. While the reliability coefficients show that WMS-R is not a perfect test, it appears to be the best that is available and any weakness shown by the subjects has significance. The Ss' scores are given in the table that follows.

Table 9 WMS-R - Percentile Scores

Selected Subtests	S1	S2
Digit Span		
Forward	16	37
Backward	<2	85
Visual Memory Span		
Tapping Forward	31	37
Tapping Backward	66	49
Logical Memory I	26	27
Logical Memory II	37	29
Visual Reproduction I	4	33
Visual Reproduction II	9	31

S1

S1's percentiles are all below the 50th percentile except for Tapping Backwards which is a visual memory task. His lowest score is for Digit Span backwards which is the non-visual counterpart of tapping backwards. It is significant that he got a low score on Digits Backwards because this subtest is particularly sensitive to injury to the brain. This subtest presents difficulty because the examinee has to keep the numbers in mind while juggling the information in order to reverse the numbers so this is a more complex mental task than Digits Forward (Lezak, 1983).

S1 also had problems with Visual Reproduction which requires the person to draw designs from memory. His poorest score on this test was for Immediate Recall which does not discriminate between patients with either right or left hemisphere lesions (Delaney et al, 1980). With Delayed Recall at 30 minutes, a low score is indicative of right temporal lesions (Lezak, 1983). Observationally, his behavioral evidence of memory deficits also indicates temporal lobe lesions.

S2

S2 obtained normal scores on all the WMS-R subtests and he did remarkably well on the difficult task of Digits Backwards. In fact, he would have got an even higher percentile if it were not for his decision to discontinue Digits Backwards when he was still getting all the answers correct. In this test the examinee is supposed to continue either to the end of the test or until they get two consecutive answers incorrect. The technician tried to encourage S2 to continue but he just decided he had done enough already.

S2's success with Digits Backwards is also interesting because Lezak (1983) wrote that patients with right hemisphere damage and visual field deficits get lower scores on this test than patients with right hemisphere damage without visual field deficits. Given that S2 had hemianopia and right hemisphere damage, his skill on Digits Backwards is not what one would have expected.

S2's lowest scores are for Logical Memory I and II but they are still within normal limits. So the WMS-R does not support memory deficits for S2. Nevertheless, S2 made religious use of his memory book and indications were that he needed to do so. Speculation by the researcher combined with comments made by S2 suggested that he had problems with planning and initiation which he was able to overcome through his religious use of his memory book. He frequently expressed concern about forgetting things if he did not write them down.

WCST: Discussion of Results

Drewe (1974) wrote that examinees with frontal lobe lesions have more problems with the WCST than patients with localized lesions of the posterior cortical regions.

Table 10 WCST - Percentile Scores

WCST	S1	S2
Perseverative Errors	39	58
Perseverative Responses	45	63
Categories	>16	>16

S1

The evidence from the WCST demonstrated that the scores of S1 were below the mean but within normal range on the three subtests of the WCST. But the greatest problem is with the Categories achieved. However, >16 is still within normal range.

S2

S2 got scores above the mean for Perseverative Errors and for Perseverative Responses, but Categories achieved was below the mean. Nevertheless, his score was still within normal limits.

CFT: Discussion of Results

Brooks (1972) found that people with brain injury did significantly poorer than controls because cerebral lesions cause a double disadvantage. First of all the person has a less efficient learning system and, second, the person forgets more information than controls do.

Table 11 Complex Figure - Percentile Scores

Complex Figure Test	S1	S2
Copy	45	45
Recall at 30 minutes	9	25

S1

On the CF test the percentile scores for S1 are 45 for the copy and 9 for delayed recall at 30 minutes which indicated that he had a problem with delayed recall for visual material. The percentile of 9 shows that S1 is mildly impaired as far as delayed visual memory is concerned.

S2

S2 has percentile scores of 45 for copying the CFT and 25 for Delayed Recall at 30 minutes. So, he is within normal range for Delayed Recall because his score is above the 16th percentile. S 2 had problems with finding his way around, which is a specific visual memory deficit that affects people with aneurysms of the right posterior cerebral artery and it relates to movement within new environments.

PMT: Discussion of Results

This was a draft version of a PMT by Barbara Wilson who designed the Rivermead Behavioural Memory Test (1989). This test included both event-based and time-based tasks. It was only in the developmental stages and, nevertheless, she was kind enough to send it to the researcher. This test was interesting to work with and made apparent what the problems are that are involved in designing a prospective memory test. Numerical instructions were not included so the researcher allocated 20% for each of the 5 prospective memory tasks and the results were as follows (See Appendix for the Prospective Memory Test and the scoring that was used).

Table 12 PMT - Percent Scores

S 1	S 2	Mean
90%	50%	70%

S 1

S1 took advantage of the instructions to use whatever technique he wanted to remember what had to be done. Consequently, he made notes of the prospective memory tasks that he was given. Also, he was careful to maintained vigilance as to the prospective memory tasks while he was also concentrating on Ravens Coloured Matrices. S1 has both retrospective and prospective memory deficits, but behaviorally he consistently demonstrated good executive functioning so he did an excellent job of compensating for his prospective memory deficits and did well on the test.

S 2

S2, was also careful to write down what the prospective memory tasks were. But he tended to have problems with monitoring time while engaging in another task. In short, S2 wrote down the information he needed for the prospective memory tasks but sometimes he forgot to check what he was supposed to do at the appropriate time so his score was considerably lower than that of S1.

It was recommended by B. Wilson that the Ravens Coloured Matrices and the Hospital Anxiety and Depression Scale be given in conjunction with the Prospective Memory Test. However, it was decided to not give the Hospital Anxiety and Depression Scale or any other depression scale because both Ss felt uncomfortable about the implication that they were depressed because they had a brain injury. Therefore, to avoid placing them in an uncomfortable situation, the long version of Ravens Coloured Matrices was used to ensure that they would not complete this filler task before the 20 minute Prospective Memory Assessment was completed.

APPENDIX F

Reliability and Validity of Neuropsychological Tests.

The following neuropsychological tests were done at the conclusion of the EO CACR program. Therefore, these tests were a current indicator of the Ss cognitive status at the time of the study.

WAIS - R

The WAIS-R (1981) has six verbal subtests which are: Information, Digit Span, Vocabulary, Arithmetic, Comprehension and Similarities; and it has five performance tests which are: Picture Completion, Picture Arrangement, Block Design, Objet Assembly and Digit Symbol. The reliability and validity are discusses below.

Reliability

Reliability Coefficients are used to determine the level of agreement that is obtained when the instrument is administered two or more times. Test-retest reliability of the WAIS-R includes the two previous versions which are the Wechsler-Bellview and the Wechsler Adult Intelligence Scale. The reliability coefficients for these instruments are presented by Kaufman (1990) who stated that the reliability coefficients for the WAIS and WAIS-R are similar. Therefore, not only is test-retest reliability supported but additional subtests were added to the WAIS-R which increases its reliability still further. The split-half reliability coefficients for the WAIS-R range from .68 to .97 and the test-retest reliability coefficients range from .70 to .96 Kaufman (1990).

Validity

Anastasi (1988) writes that three internal consistency (which is the correlations between each subtest and the score for the full batters) supports construct validity and this will be discussed.

Internal Consistency

The internal consistency data provided by Kaufman (1990), consists of correlations which range between 0.48 to 0.84 for the Wechsler-Bellview I (1938), the Wechsler Adult Intelligence Scale (1956) and The Wechsler Adult Intelligence Scale - Revised (1981).

WMS-R

The Wechsler Memory Scale - Revised (WMS-R), was developed to diagnose memory deficits. But Kaufman cautions that this instrument was normed on only a small sample of people who were from 16 - 74 years old. Therefore, there are low reliabilities for several components of the instrument. Nevertheless, the WMS-R is well known for its significance in diagnosing memory problems.

Reliability

Wechsler (1987) presents the five-subtest General Memory scale with its low mean reliability coefficient of .81. Verbal Memory had a mean of .77, Visual Memory had a mean of .70, Delayed Recall had a mean coefficient of .77. However, Attention/Concentration did better because it had a mean of .90. Except for Attention/Concentration, the reliability coefficients indicate that the WMS-R is somewhat lacking in reliability.The disadvantage is that the WMS-R was standardized on a small number of people so that the norms for the various age groups have low reliability and stability for most scales and all the subtests.

Validity

Kaufman writes that the current version of the WMS-R has been greatly improved over that of 1945 because of the addition of several new memory tasks, measures of delayed recall and improvement in the scoring system. What is important for this study, is that the WMS-R has been validated on people with amnesia and their mean scores ranged from 69 on General Memory to 100 on Attention/Concentration.

WCST

The reliability of the WCST has been upheld but the validity of the WCST for diagnosing frontal lobe lesions appears to be in question.

Reliability

Axelrod, Goldman and Woodard (1992) studied the interscorer and intrascorer reliability of the WCST whereby the procedures of Heaton (1981) were followed. They found strong interrater reliability for experienced administrators of the WCST with regard to scoring perseverative responses, perseverative errors, and nonperseverative errors. The intraclass correlation coefficients for experienced raters range from 0.88 to 0.96 (Axelrod et al, p. 147).

Validity

The validity of the effectiveness of the WCST in diagnosing frontal lobe lesions appears to be controversial. Milner (1963) found that patients with dorsolateral frontal lesions obtained poor scores on the WCST. In contrast, Mountain and Snow (1993) found that the WCST was ineffective for diagnosing dorsolateral-frontal lesions.

Heck and Bryer (1986) also question the validity of the WCST for diagnosing frontal lobe lesions. They studied a 41 year old female with evidence from a CT scan showing bilateral frontal atrophy of the orbital and dorsolateral frontal areas. Yet, this woman did well on the WCST and did not show evidence of frontal lobe problems according to the results of the WCST. Nevertheless, she had problems with planning, irritability, mood swings, and disrupted interpersonal relationships which are all indicative of deficits of the executive functions. These behaviors are consistent with the frontal lobe pathology shown on the CT scan but the results of the WCST would suggest that these frontal lobe lesions did not exist.

Given the above, the validity of the WCST for diagnosing frontal lobe deficits, and consequently deficits of the executive functions, appears to be questionable. Therefore, further studies should be done to determine appropriate means for determining frontal lobe pathology and deficits of the executive functions.

CFT

Lezak (1983) writes that the CFT by Rey (1941) was designed to diagnose perceptual organization and visual memory problems in people who sustained injury to the brain. Then, Osterrieth (1944) standardized Rey's procedures and obtained normative data from 230 non-impaired people who ranged in ages from 15 to 60 years. Osterrieth also assessed children with learning and adjustment problems as well as 43 adults who had sustained traumatic injury to the brain

Reliability

Axelrod, Goldman, and Woodard (1992) state that the Rey Osterrieth Complex Figure Test (Osterrieth, 1944) tends to have poor reliability because examiners have difficulty scoring this instrument.

Validity

Because executive functional deficits have been related to frontal lobe lesions, the Wisconsin Card Sorting Test (WCST) was used to assess frontal lobe lesions and the scores were compared to the results of the Postinstruction Assessment .

Lezak (1983) cites Messerli, Seron, & Tissot (1979) as finding that patients who had predominantly frontal lobe lesions tended to repeat elements of the drawing that had already been copied and they used a disorganized approach to their drawings. One-third drew a familiar design such as the circle with three dots as a face. Surprisingly, they found that perseveration occurred less often than expected.

Lezak writes that patients with frontal lobe problems have difficulty copying the figure and patients with parietal-occipital lesions have difficulty with spatial organization. She also says that people with left hemisphere lesions tend to draw the basic rectangle and structural elements as a whole. But, people with right hemisphere lesions draw figures that are poorly integrated and their copies are much less accurate than those of people with left hemisphere damage.

Lezak cites Pillon (1981) as finding that patients with parietal-occipital lesions had problems copying the figure correctly and that patients with frontal lobe lesions had this problem as well. Examinees with parietal-occipital lesions had difficulty with the spatial organization of the figure whereas patients with frontal lesions had difficulty programming how they would approach the drawing. But patients with frontal lobe problems improved when they were given a plan to help them copy the drawing. Pillon's finding is consistent with the planning deficits that are attributed to lesions of the frontal lobes.

Finally, Brooks (1972) found that the Complex Figure test was sensitive to the memory deficits for older people who had sustained injury to the brain. Therefore, all these observations have to be kept in mind when assessing the validity of the Complex Figure Test.

Wilson (draft) Prospective Memory Test

This is a draft version because a Prospective Memory Test is currently under development by Barbara Wilson. Designing tests for prospective memory is a new field of study and prospective memory assessment is much more complex than for retrospective memory assessments. The test used for this study required the examinee to engage in a filler task while being required to remember to do certain things within a 20 minute session (See Appendix C).

Reliability

Because this test is under development, reliability studies are not available. However, in the writer's limited experience, it appears that this test would have had increased reliability if the open ended component of each question which says "If not describe what happened" were replaced by specific examples of what could have happened for the examiner to check off. The test could read: "Examinee remembered that s/he was to do something, but could not remember what it was" or "Examinee did not seem to have any awareness that a task was to be performed at that time". Remembering that a task had to be performed could be valued at 1/2 a point whereas total failure to remember should be valued at zero. Perhaps a variety of potential responses could be listed and given numerical values so the instrument is more precise and consistency of data will be more likely to ensure intera-rater and inter-rater reliability.

Because values were not assigned to the tasks, the researcher arbitrarily assigned values and partially incorrect answers were given half a point and totally incorrect answers were given zero (See Appendix C). Therefore, both subjects were assigned the same values for each question so the results have comparative value for this research.

Validity

Studies on the validity of this test are also not available. However, it appeared to the writer is that this test in its present format is more of a test for executive function rather than a prospective memory test. The reason for drawing this conclusion is because the examinee is told that they may use whatever technique they likes to use to help remember the tasks that have to be done. Recognizing the presence of a prospective memory problem and recognizing the need to use a compensatory approach demonstrated executive or metamemory skills .

Some thoughts for overcoming these problems are as follows:

i The first time the test is given prevent the examinee from using compensatory approaches to cope with prospective memory deficits. Because if the person makes notes as to what has to be remembered, this is assessing their ability to compensate for prospective memory deficits may demonstrate of how organized the person is which may or may not relate to prospective memory problems.

ii In addition to the present questions include additional tasks to be performed at 40 minutes, one hour, one day later, three days later and one week later. These tasks could involve such activities as placing a phone call to a certain number at certain times and this could be objectively assessed by the examiner if the examinee is required to leave messages on a telephone answering machine that gives the time along with the recording of the message.

iii The prospective memory test should be given twice and on the second time, the person should be encouraged to use compensatory techniques and then the results of both tests should be compared. This way prospective memory deficits could be ascertained as well as the person's ability to recognize and compensate for prospective memory deficits.

Not only does the reliability and validity of assessment instruments have to be taken into consideration so that unwarranted conclusions are not drawn but other ethical factors have to be considered at well.

APPENDIX G

Ethics Committee

Re: Questions from Ethics Committee

Point 4: This question refers to whether or not a minor has the option to opt out of the study when the guardian has consented to the study.

First of all, this study is for adults only. However, in the unlikely event of a dependent adult, the dependent adult's wishes regarding the study would have precedence over those of the guardian. This would be pointed out to the participant and the guardian and both would be required to sign the consent form.

Points 5 & 6: It is anticipated that this study will be conducted in the 7th floor computer lab at the Faculty of Education so it is improbable that the clients will be in-patients in a hospital. Therefore, except for the release of the neuropsychological test results which have to be sanctioned by the participant, it appears unlikely that there would be a conflict between the Department of Adult, Career, and Technology Education Ethics Committee and the hospital ethics committee. However, if necessary because the neuropsychologist were on the staff of a hospital, the approval of the head of the hospital Department where the neuropsychologist is employed, would be sought regarding the intended research.

In the unlikely event of the study being run on a patient in a hospital setting, after approval from the Adult, Career and Technology Education Ethics Committee had been obtained, it would then be necessary to seek the approval of the hospital's Ethics Committee. Should that happen, an abbreviated copy of the research proposal and the Computer Assisted Cognitive Rehabilitation training program would be submitted to the Chairperson of the hospital's ethics Committee. Then, if further clarification was necessary, the researcher would present the additional information to the Adult, Career and Technological Education Ethics Committee for further consideration.

With regard to the neuropsychologist, should they want to know how the participant is doing with the memory rehabilitation training program, the neuropsychologist would be told about the participant's progress as it relates to the computerized data collection for the study.

Point 8: In accordance with the recommendation of the ethics committee, the statement that "no deception is involved" has been included in the consent form that is attached.

APPENDIX H

Ethical Considerations

The guidelines of the General Faculties Council are presented below and reviewed in terms of this study.

Guideline 1 -- If research procedures could potentially produce physical or mental harm for the participant, the investigator must asses the magnitude and present justification . (Safeguarding Participants).

Because this study merely involved CACR, no physical or mental harm to the participants was anticipated or observed and no deception was used to conduct this study.

Guideline 2 -- Where possible, participants must give fully informed and voluntary consent to participation.. (Safeguarding Participants).

Participation in the study was on a voluntary basis and the participants knew that they had the right to opt out at any time. The nature and purpose of the study was fully explained prior to gaining their consent and in the case of S1 the consent of his guardian was also obtained. However, consent of a guardian was not necessary in the case of S2 (See consent form in Appendix B).

Guideline 3 -- Where possible, participants must be guaranteed anonymity and their responses treated with confidentiality. (Safeguarding Participants)

Participants confidentiality was maintained throughout the study. Only the researcher, the duly qualified neuropsychologist and his qualified technician had access to the neuropsychological data. This data was kept under lock and key and was not put on any file server or machine with public access. All notes were destroyed at the end of the study.

Guideline 4 -- Researchers must be competent in their area of inquiry, familiar with appropriate ethical guidelines, and sufficiently aware of the possible uses to which the results may be put in order to make responsible decisions. When in doubt about the application of these guidelines, the investigator is encouraged to consult with informed colleagues and supervisors. (Role of the Investigator).

The researcher became sufficiently knowledgeable about the procedures and risks of the study to make the responsible decisions in accordance with this guideline because of: prior experience in working with this population; the development of the research proposal; and from consultation with the supervisor and colleagues. All unanticipated concerns which arose during the study were dealt with through further discussions with the supervisor and colleagues.

Guideline 5-- The investigator must ensure that all individuals under the investigators' supervision have the training and competence needed to carry out their responsibilities. (Role of the Investigator)

The researcher was the sole person involved in the development and in the training of the participants in the EO CACR program . Also, the investigator was the person involved in the collection of the EO CACR data and background data on the participants. However, a neuropsychologist and his technician volunteered to do the neuropsychological testing that was required, because both were professionals, the training and competence of these individuals was not an issue.

APPENDIX I

EO CACR Program

Prospective Memory Rehabilitation: Electronic Organizer Training through Computer Assisted Instruction

This EO CACR program (Owen-Flood, 1994) is in the pocket at the back of the thesis cover.

APPENDIX J

Instructions for entries into EO

Instructions: Prior to presenting the EO CACR program, put the follow into the SCHEDULE section of the EO.

Unit 4

Exercise 7:

a. On April 16, 1994, 9:30 AM, type: "CLEAN HOUSE"

b. On January 9, 1994, 6:30 PM, type: "SUPPER"

c. On March 5, 1994, 7:00 PM, type: "WATCH TV"

d. On November 10, 1994, 10:00 PM, type: "GO TO STORE"

e. On April 2, 1994, 1:00 PM, type: "PHONE JIM"

Unit 5

Exercise 2:

a. On February 28, 1994, 11:00 AM, type: "PAY GAS BILL"

b. On March 5, 1994, 2:30 PM, type: "WRITE TO MOTHER"

c. On November 10, 1993, 11:00 AM, type: "BUY PRESENTS"

d. On January 9, 1994, 6:00 PM, type: "CHECK WEATHER"

e. On April 16, 1994, 7:00 PM, type: "PARTY"

Exercise 5:

a. On February 28, 1994, 9:00 AM, type: "PAY THE RENT"

b. On February 7, 1994, 9:00 AM, type: "FEED THE DOG"

c. On March 5, 1994, 3:00 PM, type: "STAMP LETTER"

d. On March 2, 1994, 10:30:00 AM, type: "SEE DR JONES"

e. On March 2, 1994, 9:30 AM, type: "LEAVE FOR DR JONES"

APPENDIX K

Curriculum Vitae

JILL P. OWEN - FLOOD

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Canada
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Education

Master of Education in Instructional Technology (1994), Department of Educational Psychology and Technology, Faculty of Education, University of Alberta.

Diploma in Counselling Psychology (1986), Department of Educational Psychology, Faculty of Education, University of Alberta.

Bachelor of Education (1971), Department of Industrial and Vocational Education, Faculty of Education, University of Alberta.

Junior "E" Certificate (1962), Department of Elementary Education, University of Alberta.

Awards

Canadian Federation of University Woman, Edmonton, Mature Student Bursary (1993).

University of Alberta, University Bursary (1993).

University of Alberta, Mary Louise Imrie Graduate Student Award (1992).

Government of Canada, Bursary in Vocational Education (1965).

Conference Presentations and Projects

World Federation of Occupational Therapists, London, England, April 21, 1994,. Speaker presentation on: Prospective Memory Rehabilitation: Electronic Organizer Training Through Computer Assisted Cognitive Rehabilitation. Presenters: J.P. Owen-Flood, Professor M. Miyazaki and Dr. M. Szabo.

American Occupational Therapy Annual Conference and Exposition, Seattle, Washington, June 21, 1993. Speaker presentation on the software for the Electronic Organizer Computer Assisted Cognitive Rehabilitation program. Presenters: J.P. Owen-Flood, Professor M.Miyazaki and Dr. M. Szabo.

Hong Kong International Occupational Therapy Conference, September 19, 1992. Poster presentation on: Validation of Computer Assisted Instruction for Memory Book Training for People with Brain Injury. Presenters: J.P. Owen-Flood, Professor M. Miyazaki and Dr. M. Szabo.

Pacific Coast Brain Injury Conference, October 19, 1991. Poster presentation on: Cognitive Rehabilitation through Memory Book Training. J.P. Owen-Flood, Professor M. Miyazaki, and Dr. C.H. Preitz.

Ethics and the Crisis in Healthcare Organization, May 1994. I was one of the members and participated in the writing of the May 1994 Declaration on "Healthcare reform without further privatization" which was founded on a focus on values in a changing world.

Employment

1983 - 1994: Convalescence from orthopedic programs followed by university training.

1979 - 1983: Special Education teacher at Edmonton General Hospital. Duties: assessments, interdisciplinary teams, working with hospitalized children from Grades 1 to 12; acting as a liaison between the hospital and home school teacher. I worked in paediatrics, adolescent psychiatry and specialized in teaching students with neurologically based cognitive deficits which included brain injury rehabilitation..

1968 - 1979: Business Education teacher at St. Joseph's High School. Duties: Group and individualized instruction, job training, student assessment and working with families.

1962 - 1968: Elementary school teacher. Duties: Taught all subjects in the Grade 1 and 2 . This involved group and individualized instruction and supervision, basic skills and working with families.

Executive Positions

Vice-President of the Canadian Federation of Artists from 1983 - 1984.
President of the Edmonton Art Club from 1977 - 1978.
Vice-President of the Edmonton Art Club from 1976 - 1977.
Program Chairman of the Edmonton Art Club from 1975 - 1976.
Member of the Board of Directors of the Edmonton Art Gallery from 1977 - 1978.

Memberships

Head Injury Association of Alberta
Northern Alberta Brain Injury Association
Edmonton Neurobehavioral Society
Society for Instructional Technology Edmonton
Canadian Association on Gerontology
Alberta Teachers' Association

Volunteer Work

I worked in cognitive rehabilitation at the Brain Injury Unit at Alberta Hospital Ponoka, Ponoka, Alberta from 1988 - 1990.

August 31, 1994